THESIS

THE ADMINISTRATIVE CONTROL OF MATERIAL QUALITY

FOR NAVAL VESSELS

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M. J. JOHNSON, LCDR, SC, USN

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PREFACE

Before obtaining access to the data used in the preparation of this paper, the writer was advised by the responsible government custodians that an identification of any data to the associated private contractor involved should be avoided since such identification might constitute a violation of the government's special trust with respect to safeguarding proprietary and privileged information. He was also advised by government officials interviewed that they preferred that their names not be cited when making reference to their remarks and opinions. Accordingly, no specific contractor or government official has been identified in this paper.

Acknowledgment is made to those officers and civilian employees of the Office of the Assistant Secretary of the Navy for Installations and Logistics, the Office of the Chief of Naval Material, the Naval Ship Systems Command, the Naval Supply Systems Command, and the Ships Parts Control Center, whose assistance contributed significantly to the preparation of this paper.

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LIST OF ABBREVIATIONS AND ACRONYMS

APL	Allowance Parts List
BuSandA	Bureau of Supplies and Accounts
BuShips	Bureau of Ships
CFE	Contractor Furnished Equipment
CID	Component Identification
CNM	Chief of Naval Material
COSAL	Coordinated Shipboard Allowance List
DCASR	Defense Contract Administration Services Region
DPR	Defect Prevention Report
ESO	Electronic Supply Office
FSN	Federal Stock Number
GFM	Government Furnished Material
ICP	Inventory Control Point
INDMAN	Industrial Manager
INM	Inspector of Navy Material
NAVSHIP	Naval Ship Systems Command
NAVSUP	Naval Supply Systems Command
NSTR	NAVSHIP Technical Representative
RDT&E	Research, Development, Test, and Evaluation
SINS	Shipboard Inertial Navigation System
SPCC	Ships Parts Control Center
SubSafe	Submarine Safety Program
SUPSHIP	Supervisor of Shipbuilding

INTRODUCTION

The Navy attempts to always employ ships constructed of reliable material to protect and defend the United States against attack on the sea, under the sea, and in the air. To this end, there is a strong and growing interest in the administrative procedures for assuring that the ships parts procured by the Navy are of the required quality.[1] This interest has been catalyzed by an increasing recognition of the tangible and intangible costs to the public and the government of inferior quality. Understandably, material quality is of vital concern to the Department of the Navy, a buyer and consumer of vast quantities of supplies and equipment.

The Department of the Navy has been directed by the Secretary of Defense to procure and operate its vessels at the lowest possible cost. In this context, one of the prime objectives is to obtain quality ships parts at a reasonable price.[2] Within the Department, the Naval Ship Systems Command (NAVSHIP)[3] and the Naval Supply Systems Command (NAVSUP) are both responsible for the attainment of this objective.

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[1]U.S., Department of the Navy, Bureau of Naval Personnel, Logistic Support of the Navy (NAVPERS 10495), September 15, 1965, p. 1.

[2]U.S., Department of Defense, Office of Secretary of Defense, Quality and Reliability Management (Volume I), August 4, 1966, p. 53.

[3]A list of abbreviations and acronyms used in this report is found at page vi.

The Problem

While NAVSHIP and NAVSUP are both responsible for the procurement of ships parts, NAVSUP is concerned primarily with the procurement of replacement parts that conform to the quality requirements specified by NAVSHIP. These requirements are provided either in the form of standard specifications or letters, notices, and instructions periodically promulgated to cover specific issues. Yet, despite these precautionary procedures, serious administrative problems still arise concerning the quality of material as evidenced by the continual receipt of failure reports from the end users. The purpose of this study is to:

1. Identify and clarify the organizational relationships and responsibilities of NAVSHIP and NAVSUP as they relate to the quality control of ships parts,

2. Examine and evaluate NAVSHIP's and NAVSUP's supply support quality control procedures applicable to the acquisition of these parts,

3. Define and appraise NAVSHIP's and NAVSUP's joint defective prevention program for controlling and improving the reliability of ships parts, and

4. Recommend changes to administrative controls which will correct any weaknesses noted by this study and thus aid in the acquisition of ships parts of the required quality.

The Method

The method that this study employs for clarifying the organizational relationships and responsibilities of NAVSHIP and NAVSUP and evaluating the administrative procedures associated therewith which relate to the quality control of material will involve:

1. A comprehensive clarification of the quality control organizations and responsibilities of NAVSHIP and NAVSUP,

2. An examination of the current system and administrative supply support quality control procedures applicable to the acquisition of ships parts,

3. An objective appraisal of current performance in terms of results and problems as they relate to the defective prevention program, and

4. The formulation of recommendations in terms of modifying, expanding, simplifying, or combining procedures which comprise the system for the purpose of aiding in the achievement of greater reliability in the ships parts required by the Navy.

Sources of Data and Information

The calendar years 1963, 1964, and 1965 were selected for analysis of prior performance (a) because they were current and (b) because they are considered specifically representative of future conditions in terms of the expected problems now inherent in obtaining and identifying quality material. Statistics used in the preparation of this paper were obtained from NAVSHIP, NAVSUP, and the Ships Parts Control Center (SPCC) files and records as well as reports from industry. In addition to written records, unstructured interviews were conducted with personnel of the Department of the Navy as well as with representatives of industry cognizant of the material quality control problems today and the strict administrative control procedures necessary to resolve such problems.

The Assumptions and Limitations

It was recognized that there may be an initial increase in cost involved in implementing recommended changes in the present administrative quality control procedures. It has been assumed, though, that any reduction in the number of failures and any increase in the safety of personnel and equipment which might be realized would ultimately justify or outweigh the initial increase in cost, if such increase should occur.

In addition to the restrictions on the use of privileged information mentioned in the Preface, the following assumptions and limitations have also been imposed:

1. Continuation of the existing NAVSHIP, NAVSUP, and their field organizational structure and staffing has been assumed.

2. Corrective recommendations have been restricted to those which do not involve or require either the enactment of a new federal statute or the amendment of an existing statute.

3. Since material support is received from numerous sources, examination of specific supply support quality control procedures has been restricted to those that NAVSHIP, NAVSUP, and SPCC follow in the acquisition of ships parts.

4. The technical development and manufacture of ships parts has purposely been avoided since the matter is considered a separate topic and not relevant to the scope of this paper.

CHAPTER I

BACKGROUND

The dictionary describes "quality" as "the degree of excellence which a thing possesses."[1] This same dictionary interprets "control" as the "authority to direct or regulate."[2]

With these definitions in mind, the purpose of this paper is to review the Navy's current administrative methods of supervising the degree of excellence of the equipments, components, repair parts and materials that make up her fighting ships. The review will include an examination of the procedures involved with the view of improvement in those areas not now exercising the full potential of the management controls available.

Since the degree of excellence of any product can be high or low, it will be assumed in this study that the quality required for Navy material and hardware will be the highest degree obtainable within the framework of the operational need and costs involved. However, as explained in the Introduction, initial increased costs will not be considered if the end quality product will eventually prove more economical when performance and safety are considered.

A certain amount of background information is necessary in order to gain appreciation for the objectives, methods, and results of any system. The

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[1]Webster's New World Dictionary of the American Language (College ed.; Cleveland: The World Publishing Company, 1966), p. 1189.

[2]Ibid., p. 322.

administration of quality control by the Navy is no exception. However, since the Navy is a complex military establishment, characterized by a highly formal organization with major segments having explicit detailed missions, a resume of those major segments most responsible for quality control of Navy material and hardware is appropriate.

NAVSHIP Organization and Mission

NAVSHIP is organized in eight functional areas under the direction of six Deputy Commanders, a Director of Contracts, and a Comptroller. The Commander of NAVSHIP delegates to each Deputy Commander, to the Director of Contracts, and to the Comptroller full authority and responsibility for the work of his assigned area, subject only to their discretion with respect to questions which they should submit to the Commander or Vice Commander of NAVSHIP for decision or further instructions.[3]

The core of NAVSHIP's mission is the design, construction, and maintenance of the ships of the fleet. The scientific, engineering, and technical functions required to accomplish this mission are under the direction of the Deputy Commanders for Research and Development; Design, Shipbuilding and Fleet Maintenance; Technical Logistics; and Nuclear Propulsion. The administrative and management functions are under the direction of the Deputy Commander for Plans and Administration, the Deputy Commander for Field Activities and Inspector General, the Director of Contracts, and the Comptroller.

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[3]See U. S. Department of the Navy, Naval Ships Systems Command, Naval Ship Systems Command Administrative Manual for a detailed description of the missions and organization of NAVSHIPS. Unless otherwise indicated, the subsequent discussions of NAVSHIP's organization and missions in this Chapter are based on this publication.

Each of the above major segments of NAVSHIP, while operating with a large degree of independence, still contributes to the efforts of each other in the overall mission to build and maintain ships. For example, most, if not all, of the Divisions of NAVSHIP having engineering or technical responsibilities participate in the planning and execution of the Research, Development, Test and Evaluation (RDT&E) program even though this program is the direct responsibility of the Deputy Commander for Research and Development. Others could not function until the Deputy Commander for Design, Shipbuilding and Fleet Maintenance produces the overall ship design from which a new ship is built or an existing ship is modified. Without the efforts of the Deputy Commander for Technical Logistics, who is responsible for the engineering, development, design, production, and maintenance of components, equipments, and equipment systems that are installed in naval ships or used in shipbuilding or fleet support, others could not function. By the same token, nuclear ships of the fleet would not be completed without the efforts of the Deputy Commander for Nuclear Propulsion.

The general organization pattern provides that, within each deputy commander's area, responsibilities at the division level are associated with broad areas of interest and the functions performed with respect to these areas of interest. Within each division area functional responsibilities at the branch levels are usually associated with an item or system. With respect to systems, definitions do not permit any logical means of breakdown or interpretations which can be used to assign responsibilities for systems, subsystems, equipment or components. Therefore, assignments of responsibilities are based on the function performed with respect to systems. Various codes in NAVSHIP perform the same functions except for the different systems involved. Certain

codes will perform different functions for the same systems assigned to other codes. The difference in functions usually results from time-phased situations such as contract design, construction, and maintenance stages for a ship system, or the study and prototype stage of the RDT&E tasks.

The following definitions and comments with respect to systems and subsystems provide the framework for the use of these terms throughout this paper:

1. System - a combination of parts, assemblies and sets joined together to perform a specific operational function or functions.

2. Subsystem - a system in itself which forms a part of a larger and more extensive system. Subsystems in themselves involve elements and functional consideration similar to those of the systems they support. Hence the elements of a subsystem are treated in the same manner as is used for system assignments of areas of interest.[4]

Functional responsibilities assigned to some NAVSHIP's codes are based on the following amplification. Design is intended in the broad sense to mean engineering effort. System design therefore means the required technical effort to integrate a system to accomplish its function by selecting and applying available equipment and component designs, where appropriate, and when not available, to establish the basic performance characteristics of equipment and components required to meet the integrated system performance in accomplishing its functions. Equipment and component design means the required effort to provide such equipment and components to meet specified performance and characteristics.

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[4]U.S., Department of the Navy, Naval Ship Systems Command, Bureau of Ships Instruction 5432.1 Change 5; Naval Ship System Command Manual (BuShips Instruction), March 15, 1963, p. 3.

System design functional responsibilities as they apply to other NAVSHIP's codes are based on the following general pattern. Ship design from concept of a specific ship design through completion of the contract design is the responsibility of one code. System and subsystem design not specifically related to a particular ship or ship class, and equipment and component design, is the responsibility of another code. Where applicable to a specific selection of equipment for ship design, coordination is accomplished by the code responsible for design from concept to completion of contract.

While the above is only a cursory review of NAVSHIP's organization and responsibilities, it is sufficient to impress the reader that this Command is well organized to accomplish its mission to build and repair Navy ships. The staffing includes a great number of highly qualified people who are experts in their field and well versed in the need for a quality product whether it be a complete ship or a small repair part. Instructions, conferences, symposiums, and like media available to such personnel, all combine to impress the need for quality control in product and thinking. Some of these will be discussed in Chapter II.

There are two types of field activities which are directly pertinent to NAVSHIP's overall responsibility for the procurement, construction, conversion, and repair of naval ships. These are: (1) the offices of Supervisors of Shipbuilding (SUPSHIPs) and (2) the offices of Industrial Managers (INDMANs). SUPSHIPs offices are located at private shipyards and perform a variety of duties including the administration of Navy and Department of Defense contracts with the shipbuilder, liaison duty between the shipbuilder and the Navy Supply System and perform general oversight during the construction

program. INDMANs offices have the responsibility to contract with private shipyards for the repair of Navy ships.

Consistent with their broad mission of administering Department of Defense contracts with their assigned private shipyards, SUPSHIPs are responsible for performing a multiple of procurement functions, including contracting for changes, approving progress payments, consenting to the placement of certain subcontracts, and the awarding of design contracts. They also assist with the outfitting of naval ships.

The offices of SUPSHIPs are organized in a manner prescribed by NAVSHIP. Deviations from this organization must be approved by the office of the Deputy Commander for Field Activities, and personnel ceilings and billet structures and descriptions are also controlled by the same office.[5]

This paper is concerned with the missions of SUPSHIPs to perform procurement functions, award design contracts, and assist in the outfitting of ships. In this capacity, SUPSHIPs are in an excellent position to monitor quality control requirements and insure that vessels outfitted do in fact have the complete range and depth of quality material specified. Further, authority to issue field changes to contracts is delegated to SUPSHIPs for certain items. This authority, however, is restricted to the following categories which generally do not involve specification changes:

1. Repairs or changes to Government Furnished Material (GFM) to make it suitable for its intended use;

2. Accomplishment of authorized government responsible trial items of work not required by the contract;

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[5]U.S., Department of the Navy, Naval Ship Systems Command, Shipbuilding and Boat Building Contract Manual (SUPSHIP Manual), January, 1962, para. 3-1.

3. Repairs to existing parts and components of a ship under a conversion contract;

4. Correction of government responsible design defects in systems or components which, if not corrected, would prevent operation in accordance with specifications;

5. Value engineering changes, subject to NAVSHIP approval for specific types of changes;

6. Packaging, preparation for delivery, or other action related to disposal of GFM;

7. Contractor responsible defects and deficiencies not required to be corrected by the contractor;

8. No cost or reduced cost changes not involving specifications;

9. Insurance claims which are payable by the government under the terms of the contract (prior clearance must be obtained from Chief of Naval Material);

10. Correction of design deficiencies that are considered essential by the prospective Commanding Officer of the ship under construction and concurred in by SUPSHIPs, provided each change does not exceed $5,000.00 per ship and is of the type normally considered as an alteration;

11. So-called "Polaris" changes which are unique because of their Fleet Ballistic Missile features and do not exceed $50,000.00 in estimated price, affect basic ship characteristics, or jeopardize delivery dates;

12. Changes to incorporate provisions of mandatory, government-furnished "non-deviation" plans related to the Submarine Safety Program (SubSafe);

13. Changes specifically authorized for field issuance by NAVSHIP's directives.[6]

The above responsibilities indicate that SUPSHIPs offices are an important link in the administrative chain concerned with the control of material quality. By the physical location at the building site, they can do much to insure that the ship delivered to the Navy is of the highest quality obtainable consistent with the design requirements of NAVSHIP and the multitude of quality requirements inherent in building specifications.

There are certain NAVSHIP Technical Representatives (NSTRs) assigned by major divisions of NAVSHIP and located at prime contractors' plants to represent the Navy in all matters pertinent to NAVSHIP's contracts. For example, the Naval Reactors Division of NAVSHIP contracts with a prime contractor for special propulsion plants to be provided to building yards for installation in nuclear submarines or surface craft. Since the contract involves many thousands of dollars and extensive technical coordination effort, NAVSHIP has established a liaison office at the contractor's plant to handle all facets of the contract both from an administrative and technical standpoint. Technically, all direction is received from NAVSHIP. Contractually, this liaison office represents the Defense Contract Administration Services Region (DCASR).

Among other duties, NSTRs perform the following major functions:

1. Monitor the NAVSHIP's contracts from establishment to delivery of all equipment,

2. Coordinate and assist in scheduling of all required material,

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[6] Ibid., para. 12-5.1C.

3. Maintain constant surveillance of contractor's activity and progress in the procurement of necessary components and repair parts,

4. Review and insure contractor's recommendations for component and repair part support required for building ships are acceptable to NAVSHIP,

5. Resolve technical problems as they arise concerning design, quality control requirements, or subcontractor performance,

6. Review and insure provisioning documentation prepared by the contractor or subcontractors is acceptable to NAVSHIP prior to forwarding such documentation to the Navy Supply System,

7. Provide liaison between the contractor and the Navy Supply System for all matters pertaining to required system stock, on-board support, and tender load requirements,

8. Review and reject or obtain NAVSHIP approval for requests from Navy Inventory Control Points (ICPs) for deviations in specification requirements when such activities are procuring support material,

9. Insure that contractors provide necessary source data to permit ICPs to develop and publish allowance parts lists (APLs) and coordinated shipboard allowance lists (COSALs), and

10. Coordinate all effort in the procurement, shipping, and listing of all equipment, material, and parts required for outfitting.[7]

A review of the above responsibilities indicates that NSTRs are also an important link in the Navy's quality control chain. The representatives involved are in a position to contribute much to the Navy's desire to maintain the best fighting ships in the world.

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[7]Based on discussions held with NAVSHIP, NAVSUP, SPCC, and NAVSHIP prime contractors' personnel.

NAVSUP Organization and Mission

NAVSUP, among other things, is responsible for the development, review, and promulgation of Navy-wide policies and methods governing supply management of Navy material and the administration of centrally controlled programs in connection therewith.[8] As used herein, "supply management" means the calculation of requirements, acquisition, and control of the receipt, availability, issue, and disposal of Navy material and includes provisioning, cataloging, standardization, stock coordination, inventory management, distribution, transportation, traffic management, materials handling, receipt, storage, packing, and preservation functions. This includes a responsibility for the following:

1. The development and operation of the Navy Supply System,

2. The research, development, test and evaluation of materials, methods, equipment and systems ashore and afloat consistent with NAVSUP responsibilities,

3. The management of the Navy Stock Fund and designated segments of the Navy Management Fund and such other funds or accounts as may be assigned, and

4. The centralized direction of procurement of materials and services throughout the Department of the Navy for which no other procuring activity is otherwise delegated procurement responsibility.[9]

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[8]See U. S., Department of the Navy, Naval Supply Systems Command, Bureau of Supplies and Accounts Manual, Vol. I, for a detailed description of the missions and organizations of NAVSUP. Unless otherwise indicated, the subsequent discussions of NAVSUP organizations and missions in this chapter are based on this publication.

[9]U. S., Department of the Navy, Naval Supply Systems Command, Organization Manual; NAVSUP 70, January, 1964, pp. 1-2 through 1-5.

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[illegible] of Navy [illegible] and the [illegible] [1] [illegible]

[illegible] for the following:

1. The [illegible] and [illegible] of the Navy supply system.

2. The research, development, test and evaluation of materials, methods, equipment and [illegible] responsibilities,

3. The management of [illegible] and

4. The [illegible] responsibilities.

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[1] U. S., Department of the Navy, [illegible]

[2] [illegible]

Except as otherwise prescribed in Navy regulations or by the Secretary of the Navy, the Commander of NAVSUP is responsible for the technical guidance and direction, Navy-wide, of the performance of functions, inherent in his general duties and responsibilities. Under the Chief of Naval Material (CNM), the Commander of NAVSUP directs or provides primary support for the following types of field organizations and activities (only those most responsible for quality control of Navy ship material are indicated):

1. Inventory Control Points,
2. Fleet Material Support Office,
3. Supply Annexes,
4. Supply Centers,
5. Supply Depots,
6. Navy Supply Research and Development Facility,
7. Fuel Depots and Annexes, and
8. Nuclear Weapons Supply Annexes.

NAVSUP is directed by a Commander who has the additional title of Chief of the Supply Corps and Navy Professional Assistant to the Secretary of the Navy. Orders and policy issued by Commander, NAVSUP, in the execution of his assigned functions, are considered as coming from the CNM and the Secretary of the Navy. The Vice Commander of NAVSUP acts in his absence.

To assist the Commander and Vice Commander in their duties, a Policy Council is established to provide a communication media between Command and top management officials in which major policy and objectives and important matters of current interest are discussed and brought to the attention of council members. Individual members of the council in turn serve as a line of communication between top management and NAVSUP personnel. The council,

in addition to the Commander and Vice Commander, NAVSUP, is composed of the Inspector General of the Supply Corps, Deputy Commanders of NAVSUP, NAVSUP Comptroller, and Staff Directorates.

A NAVSUP Deputy Commander for Policy and Plans is responsible for the analysis of broad supply support requirements as reflected in planning documents issued by appropriate authority. This includes a responsibility for the analysis of environmental and organization trends within the Department of Defense as they relate to supply support; translation of these requirements, trends, and other guidance and planning factors into NAVSUP or Naval Material Support Establishment policies, programs, and goals to meet the long range support needs of the Navy, as distinguished from specialized supply policy and implementation thereof which is the responsibility of other Deputy Commanders; development and promulgation of Department of the Navy policy governing supply and distribution of Navy material in conformance with external policy.

A Deputy Commander for Purchasing is responsible for the technical direction of field purchase functions and management control of Navy Purchasing Offices. He is supported in this mission by Contract Appeals, Purchase Policy, and Field Assistance Divisions which resolve contract problems, establish and promulgate purchase policy, and assist field activities in procurement matters.

The Deputy Commander for Supply Operations is responsible for the formulation, establishment and implementation of policy and direction, planning and coordination of NAVSUP and the interservice supply management responsibilities for inventory management. This encompasses a responsibility for the input, availability, and disposal of material; the development and

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administration of NAVSUP fleet supply and logistics support programs; the exercising of NAVSUP management control over ICPs, Navy retail offices and the Fleet Support Office and technical direction over inventory control functions at Navy stock points.

The Deputy Commander for Research and Development is responsible for the development, administration, and coordination of the research and development programs of NAVSUP and for the creation of new hypotheses and plans for development of changes to the Navy Supply System. He is assisted by the personnel assigned to the Equipment and Materials Research and Systems Research Divisions who plan and administer equipment and materials research test and development programs for planning, design, and technical guidance of ships' supply characteristics and facilities as well as conduct research in supply and logistics areas of interest.[10]

Field ICPs have been established to administer the Navy Supply System for categories of material as assigned by the NAVSHIP and other technical commands having overall cognizance of the material involved. Each ICP, of which there are currently three--the Ships Parts Control Center, Mechanicsburg, Pennsylvania; the Electronics Supply Office, Great Lakes, Illinois; and the Aviation Supply Office, Philadelphia, Pennsylvania--is under the joint control of NAVSUP and the technical command having prime responsibility for the material administered by the ICP. Some of the technical commands retain the management control of certain categories of material, such as major propulsion and generating components, and although not specifically designated ICPs, these commands perform the same inventory control functions for this material as the ICPs perform for the items assigned to such ICPs.

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[10]*Ibid.*, pp. 04-2 through 04-31.

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ICPs do not maintain stocks of material but are offices, the function of which, as stated in general terms, is to assure a proper balance between the supply of and the demand for individual items of material required for operation and maintenance of Navy ships, aircraft and shore facilities. The attainment of its objective, in general, among other things, requires an ICP to:

1. Assure that sufficient quantities of required material are on hand to supply users at all times;

2. Assure that by control of procurement, long supply or short supply will be curtailed by organizing a scheduled flow into the supply system;

3. Assure the prompt redistribution of local excesses and declaration of surplus as appropriate;

4. Maintain a proper distribution system for material under its cognizance;

5. Carry out extensive technical research programs in order to assure that all material controlled by the ICP is properly identified, cataloged, and stock numbered and interchangeability between items may be determined;

6. Develop and promulgate methods and procedures for recording and reporting stock status of material on hand;

7. Maintain close liaison with NAVSHIP and other technical commands for the purpose of incorporating changes, new designs, obsolescence, and other planning information for material under its control;

8. Maintain close liaison with stock points and other activities stocking material controlled by ICP;

9. Recommend to NAVSUP and other technical commands as appropriate the transfer of cognizance of material that may be inappropriately stocked by the ICP or other ICPs or the technical command;

10. Perform all provisioning actions necessary to procure components and repair parts, and schedule the delivery of these parts and components as requested by NAVSHIP and other technical commands;

11. Recommend and take action as appropriate to standardize components and parts where such action is feasible and desirable;

12. Prepare APLs for each component or equipment under the program support of the ICP;

13. Plan for, prepare, and publish COSALs for operating ships as directed;

14. Determine range and depth of repair parts, components, and materials necessary to outfit tenders supporting operating ships;

15. Procure ships parts and provide necessary data to publish tender load lists.[11]

NAVSUP and their field activities also are staffed with large numbers of highly trained and competent people who are involved in obtaining ships parts of the required quality at the least possible price. As with NAVSHIP, NAVSUP and field organizations prepare instructions, attend conferences and symposiums, and through other media obtain direction and advice which stresses quality control and its advantages. Some of these will be discussed in Chapter II and Chapter III of this paper.

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[11]U.S., Department of the Navy, Naval Supply System Command, Bureau of Supplies and Accounts Instruction 4421.17A; Material Mission of the Ships Parts Control Center (BuSandA Instruction), July 16, 1965, p. 1-9.

CHAPTER II

EXAMINATION OF THE SYSTEM

The purpose of this chapter is to examine the current system utilized by NAVSHIP and NAVSUP as well as their field activities in obtaining quality material for naval applications. The objective is one of identification and familiarization rather than analysis. Analytical examination has been reserved for Chapters III and IV.

NAVSHIP Existing System

Designing, building, outfitting, and contracting for a Navy ship is an extremely complicated procedure involving many people and a variety of procedures. An examination of NAVSHIP's organization as outlined in Chapter I, and attendant organization manuals referenced, will indicate that much specialized effort is required before a Navy ship can be delivered. However, since NAVSHIP has been involved in this operation for many years, procedures are standardized to a high degree. True, with each new design, peculiar problems inherent to this design will arise. True also, problems and procedures applicable to a submarine will vary considerably from those involving an aircraft carrier; however, basic system requirements remain about the same.

Tactical and logistic studies conducted by the Department of Defense and the Chief of Naval Operations determine the need for a new naval ship or additional ships of an existing type. Upon approval by Congress and authority

from the Secretary of Defense, the NAVSHIP's Deputy Commander for Design, Shipbuilding and Fleet Maintenance will produce the overall ship design from which a new ship is built or an existing ship is modified. In proceeding with this function, a study will be conducted to determine the feasibility and appropriateness of the design required. Then a preliminary ship design is prepared. Following this will be the preparation of a contract design in sufficient detail to permit the awarding of a contract for construction of a ship. Specifications provided will contain technical requirements and information relating to the construction of the specific ship involved. They will describe the general design requirements of the ship and show essential features, functions, and arrangements but not necessarily all the details of the design. Together with the contract plans and the contract guidance plans, they define the ship as to dimensions, structural arrangement, performance, tank capacities, armaments, and capabilities.

If the new ship authorized is to be similar to existing ships of the fleet, detailed requirements will be very specific. For every major Navy ship built, there is available a "Specification for Building Ships" manual which describes in detail the various requirements for the ship. By reference to an existing manual, with major deviations delineated, NAVSHIP can provide the shipbuilder with an extremely accurate set of requirements which will permit him to bid on the ship with assurance that he is fully aware of all requirements.

In the event the new ship authorized is not similar to existing ships of the fleet, more extensive research will be required by NAVSHIP before the shipbuilder can be provided with a set of requirements from which he can execute an intelligent bid. In such cases, many months or even years are from the Secretary of Defense, the [illegible] Deputy Commander for Design, Shipbuilding and Fleet Maintenance will produce the [illegible] ship design from which a new ship is built or an existing ship is modified. In proceeding with this function, a study will be conducted to determine the feasibility and appropriateness of the design required. Then a preliminary ship design is prepared. Following this will be the preparation of a contract design in sufficient detail to permit the awarding of a contract for construction of a ship. Specifications prepared will contain detailed requirements and information relating to the construction of the specific ship involved. This will describe the general design requirements of the ship and the technical features, functions, and arrangements [illegible] all the details of the design. Together with the contract plans and the contract guidance plans, they define the ship as to dimensions, structural arrangement, performance, load capacities, personnel, and [illegible].

If the new ship configuration is to be similar to existing ships in the fleet, detailed requirements will be very specific. For every major ship built, there is available a "specification for building ships" manual which describes in detail the general requirements for the ship. By referring to an existing manual, with minor deviations indicated, one can prepare the description with no excessive [illegible] set of requirements which will permit him to bid on the ship with assurance that he is fully aware of all requirements.

In the event the new ship configuration is not similar to existing ships of the fleet, more extensive research will be required to [illegible] before the shipbuilder can be provided with a set of requirements from which he can produce an intelligent bid. In such cases, many months to [illegible] years are spent by various divisions of NAVSHIP in the design and formulation of requirements for the new ship. In any event, the ultimate result will be a "Speoifioation for Building Ships" manual covering the new ship. A review of an existing manual indicates that subjects such as the following are covered in minute detail:

1. Plans,
2. Instruotion Books,
3. GFM,
4. Shipboard Tests,
5. Welding and Allied Prooesses,
6. General Requirements for Hull Structure,
7. Foundations,
8. Hull Fittings,
9. Mast, Fairings and Perisoopes,
10. Hydraulic Power Transmission System,
11. Rudders, Diving Planes and Steering Gear,
12. Control and Communioation Stations,
13. Machinery and Piping Designating and Marking,
14. Eleotrical Designating and Marking,
15. Repair Parts and Stock Components,
16. General Requirements for Living Spaoes,
17. General Requirements for Machinery Plant,
18. Propulsion Steam Turbines,
19. Pumps,
20. Salt and Fresh Water Systems,
21. Steam Systems,

22. General Requirements for Electric Power Distribution,

23. Switchboards and Panels, and

24. Nuclear or Conventional Propulsion.[1]

A review of the above requirements, which are only a sampling of subjects covered, will indicate levels of quality control required for the equipment involved. Little is left to interpretation by the shipbuilder. For example, the following samples of specifications provided for the SS(N)671 show how precise instructions are provided to the contractor:

> Inspection Facilities -- to conduct inspections, the supervisor with his assistants, shall have access at all times to the works of the contractor and shall be afforded every facility for the efficient prosecution of his work. By accepting a contract to which these specifications apply, the contractor recognizes and acknowledges his obligation to protect the interests of the government, other contractors, and himself by avoiding actions and omissions which add to the burden of the inspection service. The government reserves the right to require that specified tests be conducted at the expense of the contractor by private laboratory or by such other agency as the supervisor may approve, when the exigencies of the situation demand.
>
> Purchase Orders -- shall contain complete information as to applicable specifications and plans, firm name, location of subcontractor or vendor, the location of the material, time of completion, and any other information which may be of value or which may facilitate inspection. Each procurement accomplished in fulfillment of these specifications shall specify that the inspection and test requirements associated with the procurement are for the convenience of the shipbuilding contractor and the government and do not relieve the vendor of his responsibility to provide a high quality product which meets all the requirements of the procurement. If during the contractor's or government's own test or inspection of the equipment delivered under the procurement any condition is uncovered which fails to meet all the requirements of the procurement, the vendor is financially responsible for correcting these conditions, regardless of the testing or inspecting required.[2]

Promptly after the award of a contract, the contractor is required to prepare and submit to the supervisor schedules necessary for the purpose of

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[1]U.S., Department of the Navy, Naval Ship Systems Command, Specifications for Building Submarine SS(N)671, October 10, 1963, pp. iii-iv.

[2]Ibid., p. 2.

establishing an orderly and systematic construction program. These schedules are required to include but not be limited to the following:

1. The way schedule indicating availability of shipways and estimated time required for construction of the ship;

2. An erection sequence schedule to show the order in which the construction of the ship will take place;

3. A plan schedule showing the availability dates of plans;

4. A schedule showing required dates for material, showing dates on which all material items, including GFM, are required at the shipyard for fabrication, erection or installation;

5. A material ordering schedule showing the dates upon which each item should be ordered to meet above requirements.

The contractor is required to provide engineering and design services in the preparation of quality assurance lists, a sea trial and certification booklet and inspection, recording and reporting procedures and formats as required to provide documentation of each Subsafe and hull integrity item. He is required to certify the completion status of all Subsafe items in a form suitable for audit, utilizing NAVSHIP's approved quality assurance lists, the sea trial and certification booklet, the applicable submarine safety design review procedure manual, inspection documentation and reporting procedures prepared to meet the requirements specified above.

Further, the contractor is required to review the GFM vendor drawings, checking them against the SubSafe requirements and prepare lists to identify GFM non-destructive testing requirements needed to meet SubSafe certification. The lists are then forwarded to NAVSHIP for review, approval, and authorization

for accomplishment of the work required.[3]

Supervisor of Shipbuilding.--The above requirements imposed on the shipbuilder are specific and exacting; however, it is the responsibility of the Supervisor of Shipbuilding (SUPSHIP) to insure that they are carried out. When drawings and specifications impose high quality levels, inspectors must insure compliance. The supervisor receives specific guidance concerning his mission as quality control overseer. He is responsible for planning and coordinating the systematic discharge of the Department of the Navy's responsibility for determining that all contractual requirements have been met prior to acceptance of a ship by the government. To this end, the quality assurance engineer is responsible to SUPSHIP for:

1. Planning a uniform method by which cognizant SUPSHIP's personnel may evaluate the effectiveness of the contractor's system for assuring quality;

2. Coordinating the original and continuing process of evaluating the contractor's system for assuring quality;

3. Assuring that the contractor completely understands the quality requirements of the contract;

4. Developing a system of feedback between the contractor and the various departments of the SUPSHIP's office for corrective actions to prevent the occurrence of defective supplies or services;

5. Planning for systematic surveillance of the outputs of the contractor in the areas of design, procurement, manufacturing, storage, materials handling and operation, to assure conformance to contractual requirements, with surveillance encompassing both inspection of work and examination of records;

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[3] Ibid., p. 6.

6. Applying statistical and quality measurement techniques in the areas of verification inspection where applicable;

7. Providing SUPSHIP's planning to insure that contractual requirements for the prediction and measurement of reliability of systems and equipments are met;

8. Developing new techniques and approaches for the analysis of the quality problems;

9. Coordinating representation for SUPSHIP concerning quality problems created by contract requirements;

10. Conducting quality assurance training programs for SUPSHIP's personnel in the use of quality assurance techniques.[4]

NAVSHIP Provisioning Requirements.--are imposed on the shipbuilder in each "Specification for Building Ships." As material requirements are identified and purchase orders are prepared, the shipbuilder will invoke applicable provisioning specifications to insure that the appropriate Naval ICPs are provided necessary data to procure Navy System Stock of components, repair parts, and materials.[5]

In regard to electronic equipment, the contractor is required to furnish technical documentation and on-board repair parts for all contractor furnished electronic equipment, components, and systems which can be maintained by the ship's force through the replacement of parts or components which fail. All data is provided to the Electronic Supply Office (ESO), which has the

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[4]SUPSHIP Manual, loc. cit., section 8-2.

[5]See U.S., Department of the Navy, Bureau of Ships Provisioning Specification MIL-E-17362D (SHIPS) for electronic equipment and MIL-P-15137C for hull, mechanical, and electrical equipment.

responsibility to review such data and make determinations for system stock, assign new federal stock numbers (FSNs), identify items to existing FSNs, prepare APLs, and make necessary procurements to insure that ready for issue material is always available.

Requirements for technical documentation for hull mechanical and electrical equipment, components, systems, and repair parts are similar to those for electronic equipment. The shipbuilder will forward this data, though, to the U. S. Navy Ships Parts Control Center (SPCC). SPCC will perform essentially the same functions for this material as are performed by ESO for electronic equipment.

The following is typical of the type of technical drawings and related data that the equipment contractor is to supply to the ICP:

1. Arrangement, schematic, outline, and assembly drawings, certification data sheets and other descriptive data, as applicable, necessary for complete and positive identification of the component or equipment and for determining the relationship of one component or assembly to another or to the system as a whole;

2. Detail drawing, shop drawing, sketch and brief description, or item description sufficient to establish positive identification of each item recommended or selected as an on-board repair part and each item of sufficient maintenance significance to warrant consideration for system stock; the identifying data submitted shall contain complete identification including physical, electrical, mechanical, and dimensional characteristics.

When a design or production change affecting a repair part(s) is incorporated in the equipment being procured subsequent to submission of technical documentation to the ICP, the equipment contractor is required to immediately accessibility of [illegible]

[illegible]

Requirements for [illegible]

electrical [illegible]

[illegible]

The following [illegible]

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2. [illegible]

[illegible]

submit revised data to recipients of the provisioning list.[6] The data submitted must identify the part(s) changed, and must include detail drawings or other identification media necessary for the ICP to procure the items required.

Drawings submitted generally specify levels of quality control or special requirements necessary to procure an item. Bills of material shown on most assembly drawings indicate part numbers and actual manufacturers of the various items indicated. This permits ICPs to procure material directly from the actual manufacturer or vendor rather than from the equipment contractor.

NAVSHIP Technical Representatives.--NSTRs, who are responsible for the procurement of installed components and on-board repair parts (GFM) for the Naval Nuclear Propulsion Program, have adopted a completely unique system to insure that the ICP involved (SPCC) does, in fact, procure material to the high quality levels required for this program. Prior to January, 1964, provisioning technical documentation submitted to SPCC for identification and procurement purposes was essentially the same as described above for the shipbuilder and equipment contractor. Most material, parts, and components purchased referenced a plan, piece number or part number with little or no qualifying data. As a result, material supplied was as good as the details contained on the drawing referenced or inherent in the part number identification. However, since many drawings neglect to provide all quality control requirements or leave much up to the discretion of the manufacturer, NSTRs

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[6] U.S., Department of the Navy, Naval Ship Systems Command, Mechanical/Electrical Equipment Form NAVSHIP 4786/4786A, January, 1959.

instituted specific procedures to insure that all requirements were clear to the ICP responsible for procuring back-up system stock and tender load material.

When the cognizant technical command engineer selects a component or establishes design requirements for a new component needed for the program, a listing of all technical requirements is prepared including such data as drawings, specifications, finish requirements, cleaning requirements, packaging, special tests, inspection requirements, welding procedures, chemical and thermal limitation requirements, precautions in handling requirements, sources of supply, and pricing information.

When the provisioning project (NAVSHIP Form 4786) is prepared, an addendum page is added itemizing each of the requirements necessary to properly procure a quality component. Since not all component requirements apply to each repair part, the "REMARKS" block of the NAVSHIP Form 4786 is used to indicate which of the total requirements apply to the specific repair part. For example, a provisioning project for a valve indicates sixteen special requirements needed to procure. Each of the sixteen requirements is identified on the addendum page by an alpha designator, A to P. Line item one on the project is the "valve stem." The "REMARKS" block might indicate "A, B, D, F, P." This informs the ICP that in order to procure the "valve stem," special requirements "A, B, D, F, P" should be invoked in the contract to insure that the manufacturer will consider each special requirement in addition to the plan, piece number, or part number also referenced in the contract.

In the event operating experience dictates a requirements change to any component or repair part, NSTRs will revise the existing provisioning documentation and attendant supplemental ordering data pages and provide SPCC

with new requirements necessary to purchase quality material. In addition, each time a prime contractor, under the cognizance of NSTRs, procures any components or repair parts, a copy of the purchase order used is provided to SPCC.[7]

SPCC utilizes all the data provided and procures nuclear repair parts and components to the exact specifications and special requirements indicated. Further, the copies of prime contractor's purchase orders received, in addition to providing other sources of supply, indicate the purchase price for each item, which is valuable to SPCC in determining reasonableness of price quoted by the same or other suppliers.

In order to insure quality, SPCC, as directed by NAVSHIP's Nuclear Propulsion Commander, takes another additional step. Fourteen categories of material such as pumps, valve parts, pipe and fittings require certification and test reports with each purchase.[8] Contracts for such items specify the need for such documents and when received, are maintained on file pending any difficulty with material in service. A review of such information provides SPCC with a means to determine that material received into the supply system was certified to meet all specification and contract requirements. If service failures develop, they also provide a source of information for study which could result in revised or strengthened requirements for future procurements.

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[7]U.S., Department of the Navy, Naval Ship Systems Command, Naval Reactors Procurement Memorandum #3, October 22, 1963, p. 1 and Enclosure.

[8]Letter from K. L. Woodfin, Naval Reactors Division, Bureau of Ships, Washington, D. C., January 8, 1963.

NAVSUP Existing System

A review of NAVSHIP existing system will clearly indicate that the burden of determining technical requirements and quality control parameters is the responsibility of this command; NAVSUP must comply with these requirements as they affect the procurement, stocking, storage, and cataloging of back-up system material. Unless NAVSUP and their field activities procure and have on hand the quality material necessary to keep ships operating, much of the effort of NAVSHIP will be wasted. Further, the supply system frequently is required to furnish components, parts, and materials to build a ship. Much of the material necessary to outfit a ship with on-board spares comes from the Navy Supply System. The following will highlight the major areas of the current NAVSUP system:

NAVSUP Headquarters.--NAVSUP, under CNM, exercised administrative control over the Navy's supply operation. One of the most important functions of the NAVSUP Headquarters organization is to provide complete direction to all operating supply segments. Probably the most important document published by the Headquarters is the NAVSUP manual which provides direction to every sub-command under NAVSUP cognizance and every supply officer in the corps. Further, this manual is used for supply direction by the thousands of civilians working for the Navy Supply System. Its various volumes discuss procedures applicable to all supply areas, such as organization, operation, maintenance, quality control, reports, and requisitions, right down to the details of how to prepare correspondence. This command provides daily guidance to all operating segments of the supply system via instructions, notices, letters, and telephone as appropriate, to resolve supply problems. Conferences, symposiums, and seminars are arranged to discuss such subjects as quality control.

Supply Activities Afloat.--The field of logistics and the supply of the fleet at the operating level are by and large the province of the Supply Corps. The hundreds of supply activities throughout the world are primarily concerned with supporting the fleet. In fulfilling this role, the activities of the Supply Corps are allied closely with logistic type commands which are established to implement the delivery of goods and services to the fighting forces. The fleet supply officer is the adviser to the fleet commander on all matters pertaining to fleet supply. Ships of a fleet are grouped by ship types, each of which is under a type commander for purposes of administration. The Commander Service Force is the principal logistic agent of the Fleet Commander. With the exception of those functions specifically assigned to other commanders or assigned under joint logistic agreements, the Commander Service Force is charged with the planning, conduct, and administration of services and supply of material to the fleet to carry out approved plans and policies. The Commander Service Force coordinates the utilization of available resources to the best advantage of the fleet. Some of his major duties are as follows:

1. Advise and make recommendations to the Commander in Chief regarding fleet policies and plans for the supply of the fleet and shore activities of the area, including the supply of material and standards of readiness;

2. Establish systems of requisitioning, stock control, and issue of material consistent with policies and directives of the Chief of Naval Operations, NAVSUP, the responsible headquarters commands, and the Commander in Chief of the fleet;

3. Ration critical material and direct the redistribution of excess stock, as necessary.

The commands and supply officers involved are most interested to see that supplies are available for the operating fleet. However, it is the supply officer assigned to an individual ship who must account for all the material received and required to keep his ship in satisfactory operating condition. This officer has a variety of duties involving disbursing, subsistence, stores and ship store items. He and his staff are in a most important position to insure that material received for the operating fleet maintains the high quality condition in which it was received. His methods of maintaining and administering acceptable storage procedures for the material received are a most important link in the quality control chain. Many items of supply, especially delicate repair parts, require special handling and storage. Many parts require that special cleaning be performed on them before packaging. If a supply officer or his staff would not exercise good judgment and remove such items from their protective packages in order to conserve bin storage space, much of the quality built into the item could be lost. Further, as material or parts fail in operation on the ship, the supply officer can do much to see that clear, concise failure reports are provided to the technical commands and the ICPs involved. Good reports, with appropriate recommendations, can be instrumental in proper correction of defects and prevention of similar difficulties on other ships.

<u>ICPs</u>.--Once a Navy ship is operating, it is the duty of ICPs to insure that it will remain operational by maintaining a supply of "ready for issue" materials, components, and parts needed for repair, overhaul and maintenance. Just having the parts available is not in itself sufficient. Ships must have some means of identifying parts available in the supply system and relating

this identification to their specific requirements. This identification is accomplished in a variety of ways, some of which are enumerated as follows:

1. Each part, component, or material is identified by a FSN.

2. Each FSN is further identified by descriptive data such as plan number, piece number, or part number.

3. Plan numbers, piece numbers, and part numbers, cross referenced to FSNs, are published in catalogs such as the Fleet Oriented Consolidated Stock List.

4. Each component or equipment is further identified by a Component Identification (CID) number.

5. For each CID number assigned, there is an APL prepared which reflects a description of the component including technical characteristics and a complete list of all repair parts required by the component, with each part identified by its technical data and applicable FSN.

6. A listing of all the CID numbers applicable to a given ship is compiled, from which is published a COSAL.

The COSAL is the ship supply officer's "Bible" for identifying, ordering, and providing replacement parts and material for malfunctioning ship equipment. By the use of this publication he is able to perform the following:

1. Determine the applicable CID number for a component requiring a new repair part; this is accomplished by reference to the index of the COSAL where each equipment and component is listed by nomenclature and service application.

2. Determine the repair part FSN; this is accomplished by reference to the APL represented by the CID number located in the index. The APL shows

complete technical characteristics for the component involved as well as a complete list of all required repair parts with their part numbers and assigned FSNs. With this information, it is then possible to go to the proper storage area or bin and obtain the required replacement part.

3. Determine how many of each repair part is allowed on-board to support the equipment installed on the ship; this is accomplished by reference to the Stock Number Sequence List (SNSL) section of the COSAL. This section shows each FSN listed on the various APLs and indicates which APL utilize the various FSNs as well as the total quantity of each FSN allowed.

Obviously, the data that comprises ships' COSALs entails more than just a listing of numbers. Each APL and the technical data and identifying information contained thereon contains a great deal of exacting research by the ICP. Each FSN obtained must be supported by complete descriptive data including quality control requirements. Each APL must be reviewed for accuracy and completeness. Each contract for procurement of components and repair parts must be reviewed to determine that proper material is obtained. These and many other requirements are imposed on ICPs under the administrative control of NAVSUP.

Observations

An examination of the system utilized by NAVSHIP and NAVSUP reveals that different procedures exist for providing technical data to field activities which procure parts for naval vessels. Information provided by NAVSHIP for procurement of replacement parts generally references a plan, drawing, piece or part number, with little or no qualifying data. In the case of nuclear components and repair parts, however, detailed procedures are in effect

to insure that the NAVSHIP's prime contractor involved provides all requirements necessary for replacement procurement of each ship's part. Information provided is specific and the format for qualifying data reflected on drawings is on a line item basis. The procedure includes the requirement for an identification of the exact quality applicable for each part.

In view of the functions and offices involved, it appears evident that if the work required for the building, conversion, repair, and upkeep of naval vessels is to be accomplished with dispatch and accuracy, it is incumbent upon all NAVSHIP's divisions to furnish to requiring field activities clear and precise data concerning the supply support and operating requirements of the equipments involved. In non-nuclear equipment areas, it is noted that the internal NAVSHIP procedures applicable to the guidance to be furnished to SPCC and other field activities for the procurement of ships parts need to be updated. For example, The Bureau of Ships (BuShips--former name of NAVSHIP) Instruction 4400.11, which delineates the procurement specifications and technical data to be furnished to requiring field activities, is dated June 9, 1955, and specifies that certain information is to be provided to a field supply activity which is not now in existence.[9]

In respect to the acquisition of parts for naval vessels, it is noted that the ships parts support functions of the Chief of Naval Material (CNM) are divided between NAVSUP and NAVSHIP. NAVSUP is responsible for supply policy and inventory management administration through SPCC and other inventory control points. NAVSHIP is responsible for technical guidance and

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[9]U.S., Department of the Navy, Naval Ship Systems Command, BuShips Instruction 4400.11; Guidance to be Furnished by Bureau of Ships to Supply Demand Control Points, June 9, 1955, pp. 1-3.

equipment support for ships including their design, development, and maintenance. While supply support agreements exist between NAVSUP and NAVSHIP to clarify these responsibilities and to provide a basis for operation, it is evident that CNM has not conducted any special reviews to insure that these commands have in effect internal procedures applicable to their support responsibilities and that such procedures are being followed to acquire and supply ships parts of the quality required.

CHAPTER III

SUPPLY SUPPORT QUALITY CONTROL PROCEDURES

The existence of ICPs within the NAVSUP and NAVSHIP organizations and systems was mentioned in Chapters I and II. As previously stated, the ICPs involved receive their technical direction from NAVSHIP and their administrative guidance from NAVSUP. However, since these ICPs have a great deal of latitude in determining their modes of operation and interpreting direction from higher authority, they play an important part in the quality control of ships parts. They make determination as to how Navy ships will be supported, how material will be procured, what technical description will be used to identify an item, and what measure of quality control is essential to insure proper procurement.

Since these ICPs play a large part in keeping the Navy operational, it is appropriate that their internal supply support procedures be examined. For purposes of this examination, the ships parts support procedures of one ICP, the Ships Parts Control Center (SPCC), will be considered. This ICP is responsible for the supply support of hull, mechanical, and electrical equipment for naval vessels. Other ICPs are similar in most important respects, differing mainly in the type of material supported.

Ships Parts Support Situation

The Navy is a composite warfare system comprised of an intricate mix of some 900 submarines and surface ships of many types. Keeping this composite

CHAPTER III

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warfare system operating is a $15 billion a year operation. Keeping it supplied takes anywhere from half to two-thirds of that amount, depending on how the computation is made.[1]

The Navy's inventory of active ships includes 271 classes, ranging in size, cost, and kind from a 1,123 foot, 85,350 ton, $350 million nuclear aircraft carrier to a 50 foot, 3 ton, $30 thousand "swift" river patrol boat. These ships are several different things at once. They are floating jungles of electronic gear, highly technical weapons, communications, and target acquisitions systems with which the ships fulfill their missions. They are monstrous plants which function by means of machinery that spans the spectrum of technology.[2]

The complex technical systems the ships support generate a supply requirement of constant activity. These systems work under the sustained potential threat of malfunction that formulates not only a requirement for components and repair items of many kinds that must be provided instantly on demand but also a requirement calling for a continuing application of past engineering experience factors to the forecast of future needs.

To perform the mission expected of them, many of these ships with their varying and simultaneous needs for parts must operate thousands of miles from bases in different parts of the globe. For example, the First and Second Fleets are normally positioned near the United States, in the Pacific and Atlantic Oceans respectively; the Sixth Fleet usually operates in the Mediterranean Sea, and the Seventh Fleet in the Western Pacific Ocean.[3]

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[1]U.S., Department of the Navy, Naval Supply Systems Command, Supplying the Navy, September, 1966, p. 5.

[2]Ibid., p. 6.

[3]Ibid., p. 7.

All ships carry parts on board to be as self-sufficient as possible. The range of these stocks is tailored to the individual ship and is based on the ship's hull type, installed equipments, relative military essentiality of the ship's systems, and the composition and size of the crew. The categories of material carried include equipment related spares and repair parts and such portable equipment and other items as are necessary for the ship's operation.

These items are specified in an individual allowance list for each ship and type of aircraft on board. The items on such lists support more than 230,000 equipments and components. In this regard, it is noted that every one of the Navy's 900 ships is to a varying extent unique. Each differs from every other in certain equipment and repair parts. It is evident that more than 40,000 of the 230,000 equipments and components are applicable to only one ship.[4]

The range and depth of parts on an allowance list, that is, those specific items and the number of each which should be carried aboard ship, are generally computed to achieve the basic combat endurance of a full 90 days supply as established by the logistic support doctrine of the Chief of Naval Operations. The ship's allowance list also provides for "insurance items," or spares and repair parts for which demand cannot be accurately predicted, but without which the ship's mission could not be accomplished.

Allowances of ships are revised on an equipment basis as experience dictates but the major revision or updating of the allowance list takes place during the time the ship is undergoing overhaul. The way in which the ships

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[4]Ibid., p. 8.

parts involved are identified and described in the allowances, as discussed in Chapter II, has much to do with the procedures followed in supplying such items to the ships involved.

The Navy has long recognized the necessity for properly identifying each allowance item of material used by it. Back in 1914, the Pay Director, Mr. Thomas H. Hicks, developed the Navy Standard Catalog, which was to be a model for many similar catalogs. This catalog proved so successful during and after World War I that Mr. Hicks and his staff were authorized to establish the Federal Standard Stock Catalog in the 1920's. To insure a positive yet brief identification of all items of material, attempt has been made, since the early days of the Navy Standard Catalog, to assign one and only one number within a numbering framework to each material item. Prior to 1954, all items of material used by the Navy were identified in the "Catalog of Navy Material." Commencing in that year, and pursuant to the Defense Catalog and Standardization Act of 1952, which directed the establishment of a single catalog for the Department of Defense, Navy items began to be identified under a new system of numbering as a part of the "Federal Catalog."[5]

One complicating factor relating to the allowances and identification of the items thereon that are required for the support of ships is that of the technical nature of ships parts. These parts are generally not readily available in normal commercial channels. To have these items of the required quality available when they are needed depends on the positive steps taken to procure and distribute such parts.

The administrative procedures for providing these parts to naval vessels involve the performance of a number of functions or tasks. The steps involved

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[5]U.S., Department of the Navy, Naval Supply Systems Command, Supply Support of the Navy; NAVSANDA Publication 340, September 15, 1957, p. 15.

with these tasks must be taken well in advance of the actual need to assure effective support of Navy ships. In general, these consist of the determination of the broad material requirements and the operation or use to be made of a ship and its equipment.

General Procedure

Once a NAVSHIP contract is established with a building yard, SPCC starts planning to support the vessel involved. Building schedules are studied, purchase orders for equipment and components are reviewed, and internal schedules are developed to provision the vessel and prepare its on-board allowance lists and COSAL. Obviously, the provisioning process involved, as illustrated in Figure 1 on page 43, requires much planning and coordination of effort. This is especially true when one considers that rarely is only one vessel being built at a time.

In recent years, as many as fifty ships at a time are in various stages of completion requiring intensive program control. However, in order to simplify what takes place within SPCC, the steps that are taken to support one vessel will be considered, keeping in mind that procedures outlined can be multiplied by the number of vessels under construction and further multiplied by the number of vessels in operation requiring continuous support.

Each vessel being constructed is composed of thousands of components and hundreds of thousands of repair parts. Most of these, after various periods of operation, will require replacement. With this in mind, SPCC is organized to insure that components and parts will be ready for issue when needed. A clause is required in every shipbuilding contract which requires the shipbuilder to provide provisioning documentation to SPCC for each system, component, and repair part which will require support. This clause generally

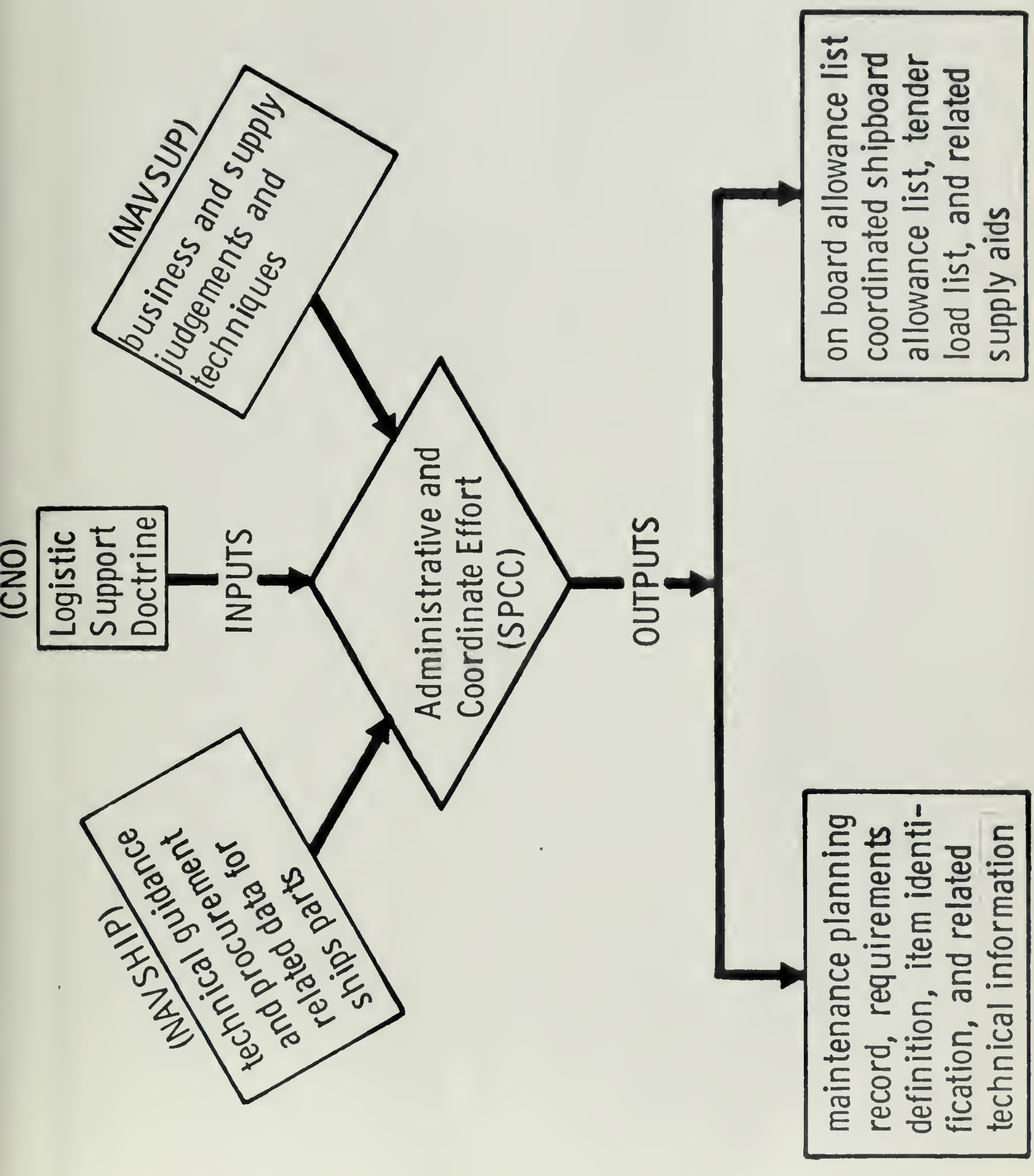

Fig. 1.--Provisioning Process

invokes a provisioning specification such as MIL-P-15137, which is designed to insure that cognizant ICPs receive adequate information to identify and procure the components and parts required.

Most of the systems and components required to build a vessel are not manufactured by the shipbuilder but are procured from various manufacturers or vendors. Therefore, it is necessary that the shipbuilder impose the provisioning requirement on each of his suppliers. As a result, SPCC receives provisioning projects, NAVSHIP Forms 4786, from the shipbuilder and a variety of his vendors. Each provisioning package is expected to be complete with all necessary drawings and other data required to identify the system, component, and repair parts involved.

Let us assume that our one vessel under consideration is composed of 5,000 components. SPCC, by review of shipbuilder listings, specifications for building the vessel, and other data, can determine at any time which components have been covered by provisioning documentation and which still have to be provisioned. Further, status of allowance list, COSAL information, and system stock procurement can be determined by data accumulated for the 5,000 components involved.

Most of the 5,000 components involved in our one ship can be categorized in three major areas: hull, mechanical, or electrical. SPCC, recognizing the distinct categories of vessel equipment, is organized technically into sections and units which are best suited to specialize in the type of equipment involved. For example, there are electrical sections, mechanical sections, and hull sections. These sections are further divided into specialized units covering such equipment as pumps, valves, propulsion and electrical machinery, and power distribution.

When provisioning documentation is received for any of our 5,000 components, a determination is made as to which section or unit will process the data involved. Further, the section or unit supervisor will then determine which individual will review the project and make the various determinations necessary to insure that proper material is eventually available to support the component on the ship.

The progression of events has led us to the core of our quality assurance concern as it relates to SPCC. The individual is now responsible to relate all of NAVSHIP and NAVSUP direction to his determination. How well he is informed and how qualified he is will determine to a large degree what material will be procured, how much will be procured, and how well it and its quality requirements are identified. This individual and others like him, who process any facet of the provisioning documentation, share responsibility for the end product. If he has been provided all drawings, specifications, and quality assurance information needed and is technically competent, there is every reason to believe that the end product in system stock will be completely suitable for its intended purpose. If any of the foregoing are missing, the end product could result in a defective prevention or failure report from the appropriate Supervisor of Shipbuilding, shipyard, repair activity, or vessel at some future date.

The individual does many things with the provisioning project he is processing. He prepares source information which will permit publication of an allowance list. He determines how many of an item are needed in system stock to support the components installed on the vessel. He determines how many of an item should be on a tender or support ship to support our vessel and he determines precisely how each item will be identified for procurement

[illegible]

[illegible]

[illegible]

purposes. It is this last feature of technical identification of the item which is most important from the quality assurance aspect.

Most of the items under SPCC's cognizance are identified by plan and piece and/or part number. Many others require extensive descriptive data in order to be procured. For common items, a plan, piece and/or part number constitutes adequate information. However, for more complicated components, material, and parts, a plan, piece and/or part number is frequently inadequate. The specifications provided with the provisioning package often offer various grades or types of items available. Drawings received are sometimes not the latest approved by NAVSHIP. Copies of shipbuilder or vendor purchase orders are sometimes not available or are not complete in that amendments citing additional requirements are not always provided. Further, drawings sometimes fail to invoke quality assurance requirements which are referenced on other documents. All of this complicates the effort involved in providing suitable support material.

During the processing of provisioning projects, it is mandatory that the individual technician involved recognize the above inadequacies of ships parts procurement and related data. All too frequently, though, the technioian, faced with work schedules and huge backlogs, will process these projects with the limited information available and identify the items involved to the best of his ability in order to move the projeots out of his work area. Although the results of suoh action usually appear, many months or even years later, in failure reports, it is evident that the technician initially involved is generally completely unaware of the material requirement information that should have been used to preclude the generation of

of such reports.[6]

Special Procedure

For many years, NAVSHIP provided provisioning information to SPCC in the manner described above. Most of the material procured was adequate and suitable for its intended purpose. An analysis of failure reports within the NAVSHIP's Naval Reactors Division, however, disclosed that certain system stock items lacked required quality which contributed to the failure of the item under study. In almost every case, it was determined that SPCC either did not receive complete information or failed to recognize some of the special requirements imposed in specifications, purchase orders, or other documents which were germane to the complete identification of an item. In order to solve this problem, the NAVSHIP Naval Reactors Commander directed their NSTRs to institute the special procedure described in Chapter II.[7]

For the past three and one-half years, the Special Propulsion Plant Branch of SPCC has utilized the supplementary ordering data pages provided with each provisioning project to insure that complete technical and quality control data is specified for every item procured. The results are now apparent. With the exception of a human error, where an individual was careless, no failure report on nuclear parts has been traced to the improper procurement of material.

The procedures followed by this branch require that each item scheduled for procurement be reviewed against the latest supplementary ordering data

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[6]Unless otherwise noted, the information provided in this chapter is based on various discussions with both NAVSHIP, NAVSUP, and SPCC personnel.

[7]U.S., Department of the Navy, Naval Ship Systems Command, <u>Naval Reactor Procurement Memorandum #3</u>, October 22, 1963, p. 1 and Enclosure.

page to insure that all requirements are specified in the procurement description. Each procurement description provided by this branch to the Purchase Division of SPCC is accompanied by a specification check-off list on which the specifications applying to the item to be procured are clearly checked. Spot checks of contracts are made to insure that all required data is included.

Further, technicians in the SPCC Special Propulsion Plant Branch are trained to insure that purchase orders for ships parts invoke applicable quality requirements and are instructed not to rely on their own understanding as to the required quality if doubt exists. In this respect, the NSTRs located at the prime contractors plants have established close liaison with this Branch for the purpose of insuring that the quality requirements applicable to specific items are clarified as required. Questions concerning quality assurance requirements, interpretation of specifications, waivers requested by manufacturers, or lack of technical information are resolved by letters. Material specifications for these items and changes or waivers thereto are without exception approved by the NAVSHIP Nuclear Reactors Commander.

Observations

Provisioning of system stock material by SPCC appears to be adequate for most material procured. However, with the ever-increasing complexity of naval vessels and some of the specialized equipment involved, much can be done to improve system stock procurement for such equipment. This improvement can be accomplished by the improvement in the technical and procurement related data provided to the ICP.

Normally, manufacturers know more about their product than others not directly associated with the item. Frequently, special processes and in-house quality assurance procedures of vendors are not reflected on drawings. As a result, when procuring non-nuclear items from others, SPCC is not capable of applying every requirement to a purchase description. Since SPCC is charged with the responsibility of procuring every possible item on a non-proprietory basis, the non-availability of such information is becoming increasingly acute. While the local machine shops and smaller suppliers endeavor to provide items strictly as described, quality control processes required and not specified result in the receipt of inferior parts. Even if these requirements are detected, such detection often results in requests for waivers which are granted by individuals who generally are not fully cognizant of the special quality required.

The nuclear program procedures discussed in this chapter and Chapter II appear to be as exacting as can be established at this date. All requirements are clearly indicated. SPCC technicians do not have to depend on their own understanding or estimation of what the requirements should be. In this respect, it is noted that the specifications for these ships parts and the waivers or changes thereto are approved by one organization, the NAVSHIP Naval Reactors Division. Adherence to this type of quality control procedure appears sound in that the more people and organizations you have doing this the greater the chance is for differences or inconsistencies to appear in material requirements and in the quality of the items obtained.

Every ICP has programs or systems which are considered the most important from a quality standpoint. For example, SPCC has the Nuclear Program, SubSafe Program, Shipboard Inertial Navigation System (SINS), and the Nuclear

Weapons Program. Each of these, and others which are vital to ship operation and mission, requires a supply support system that consistently provides ships parts of the quality required. Unless quality control procedures similar to that now employed in the nuclear program are adopted, individuals at SPCC will continue to exercise their best judgment in determining applicable specifications for ships parts which may or may not be adequate. Poor judgment can only result in less than adequate material, which could result in a casualty or mission abort which may cost many times the price of complete technical data.

CHAPTER IV

DEFECTIVE PREVENTION PROGRAM

The Introduction described the need for better quality material at reasonable prices. It also highlighted the fact that despite current efforts, failure reports continue to be received from users of the material. It was further indicated that a comprehensive examination of the current administrative system and procedural techniques utilized by NAVSHIP, NAVSUP, and their field activities would be a fruitful means of identifying corrective measures.

Objective

As a part of this examination, it is appropriate to review whether or not the system is currently yielding satisfactory results. For as one management analyst has stated:

> The operating effectiveness of an area under study can best be ascertained by a comparison of the present conditions with those that were intended by its design, policy, and procedures.[1]

This chapter seeks to appraise the performance of the current system in terms of the failure reports received for ships parts. Its objectives are to:

1. Define the NAVSHIP and NAVSUP failure report procedures,
2. Examine failure report information for new parts for ships, and
3. Identify problem areas and weaknesses observed.

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[1] Systems and Procedures: A Handbook for Business and Industry, ed. Victor Lazzaro (Englewood Cliffs: Prentice-Hall, Inc., 1959), p. 97.

Failure Report Procedures

At 0917 on 10 April 1963, the USS THRESHER, SS(N)593, was lost in a tragic accident which gave every indication of equipment malfunction. Prior to this time, quality control was indeed a program, but with the exception of one or two areas was a program with insufficient emphasis. The USS THRESHER disaster generated a concern for quality assurance in the Navy which had no previous counterpart.

Navy and Congressional investigations of the USS THRESHER incident highlighted many inadequacies in current quality assurance and quality control administrative programs. In many cases, the programs were established but frequently not adhered to in a manner which would guarantee compliance. As a result, existing programs became important, and new programs were developed to provide a degree of quality assurance previously not envisioned.[2]

Just two months and ten days before the USS THRESHER disaster, BuShips issued an Instruction which set up a Defect Prevention Report (DPR) program.[3] The instruction established the actions to be taken to prevent recurrence of defects in new parts for ships. It defines the action that engineers and others must take on DPRs and it requires coordination of the program within NAVSHIP.

When new GFM or CFE is found to be defective upon receipt, or during installation aboard ship, naval shipyards, repair facilities, and supervisors of shipbuilding personnel are required to prepare and issue a DPR, identified

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[2]U.S., Congress, Joint Committee on Atomic Energy, Hearings on Loss of the USS Thresher, 88th Cong., 1st and 2nd Sess., 1964, pp. 1-192.

[3]U.S., Department of the Navy, Naval Ship Systems Command, BuShips Instruction 4355.24; Establishment of Quality Assurance Program, Actions for Preventing Recurrence of Defects in New Equipments for Ships, January 29, 1963, pp. 1-3.

by Report Control Symbol 4355-1. Procedures stipulate that these reports shall be as complete as possible so as to permit analysis by the receiving activity for determining the required preventive action.

The initial instruction established a program to prevent recurrence of defects in new shipboard equipment which had been inspected at source by a government representative. In October 1964, however, BuShips modified this program and furnished instructions for actions to prevent recurrence of defects in ships parts which are received from stock maintained by the Naval Supply System.[4]

Copies of DPRs are now submitted either to NAVSHIP and/or the ICP involved and the appropriate DCASR or Inspector of Navy Material (INM). Reports are sent to NAVSHIP for action when the defect is considered a result of inadequate specification requirements or the defect is on GFM. If the defective material came from the Naval Supply System, a copy of the DPR is sent to the cognizant ICP for action. These reports are sent to the appropriate DCASR or INM for action when the defect is attributed to lack of conformance to specifications and/or was not detected due to deficiencies in quality assurance actions by the respective contractor.

The technical branches of NAVSHIP review the defect prevention reports. If the cause for defective items is the lack of adequate requirements, these branches are to initiate appropriate action for the correction of directives, specifications, and other technical documents. These branches are instructed to inform the activity originating the reports what NAVSHIP action is being taken.

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[4]U.S., Department of the Navy, Naval Ship Systems Command, <u>BuShips Instruction 4355; Quality Assurance Program, Prevention of Recurrence of Defects in Equipment Obtained from Stock</u>, October 28, 1964, pp. 1-2.

For GFM, when the defect is considered a contractor responsibility, the applicable NAVSHIP technical branch reports the defect to the prime equipment contractor via the cognizant DCASR or INM. The DCASR or INM will conduct a complaint investigation to determine the cause of the defect and initiate the preventive action required.

The action to be taken upon receipt of a DPR at SPCC, or other ICPs, depends upon the cause of the defect. SPCC usually purges the stock in the supply system to remove the defective material and requests its replacement by the contractor. Additionally, upon being informed of a defect, SPCC insures that the supplier involved states the cause and actions taken to prevent recurrence of similar defects. In all cases, however, copies of any SPCC correspondence involved in the processing of a DPR are to be provided to the complaining activity, NAVSHIP, NAVSUP, and the applicable government inspectors when material is actually defective and the contract number is known.

It was noted that other procedures are in effect which require that defects and failures of in-service equipment be reported on NAVSHIP Form 3621 to NAVSHIP and other activities involved.[5] The procedures also include a requirement for a report on NAVSUP 4440-80 of those defective consumable and repairable items that have been accepted into the Naval Supply System.[6] These procedures generally provide instructions for handling defective

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[5]U.S., Department of the Navy, Naval Ships Systems Command, BuShips Instruction 9000.16; Report of Equipment Failure, May 9, 1960, pp. 1-4 and Enclosure.

[6]U.S., Department of the Navy, Naval Supply Systems Command, NAVSUP Instruction 4440.120; Reporting of Defective Material Obtained through the Supply System, September 16, 1966, pp. 1-4 and Enclosure.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

material detected which does not fall within the purview of the procedure discussed above. The defect and failure reports involved cover such items as those that are shipped between stock points, in stock, and are in operation.

The above procedures provide a feedback system that is an essential and critical aspect of NAVSHIP's and NAVSUP's quality and reliability assurance programs. By feeding data and other information back to proper points in the planning, design, procurement, and production chain, as illustrated in Figure 2 on page 56, it is possible to continually reduce product variability, to improve processes, and to check the efficiency of the quality and reliability assurance program itself. Feedback information indicates the operational reliability of a product, whether it be a plan, intermediate material, or an end product, and provides the data required for an effective improvement of the processes involved.

Failure Report Information[7]

In calendar year 1964, the first full year after the USS THRESHER disaster, a review of failure report information indicates that 24 shipbuilding and other activities submitted DPRs for new ships parts. A list of the activities that submitted reports along with a definition of the sixteen defect report categories used, such as pressure test, dimensions incorrect, and parts missing, are reflected in Appendix I.

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[7]Unless otherwise indicated, the information reflected in this chapter, including the tables and appendices referenced, is based on information extracted from the official files of NAVSHIP, NAVSUP, SPCC, and a pamphlet published by the Naval Ship Engineering Center, Assurance Engineering Code 6609.1, June 1, 1966.

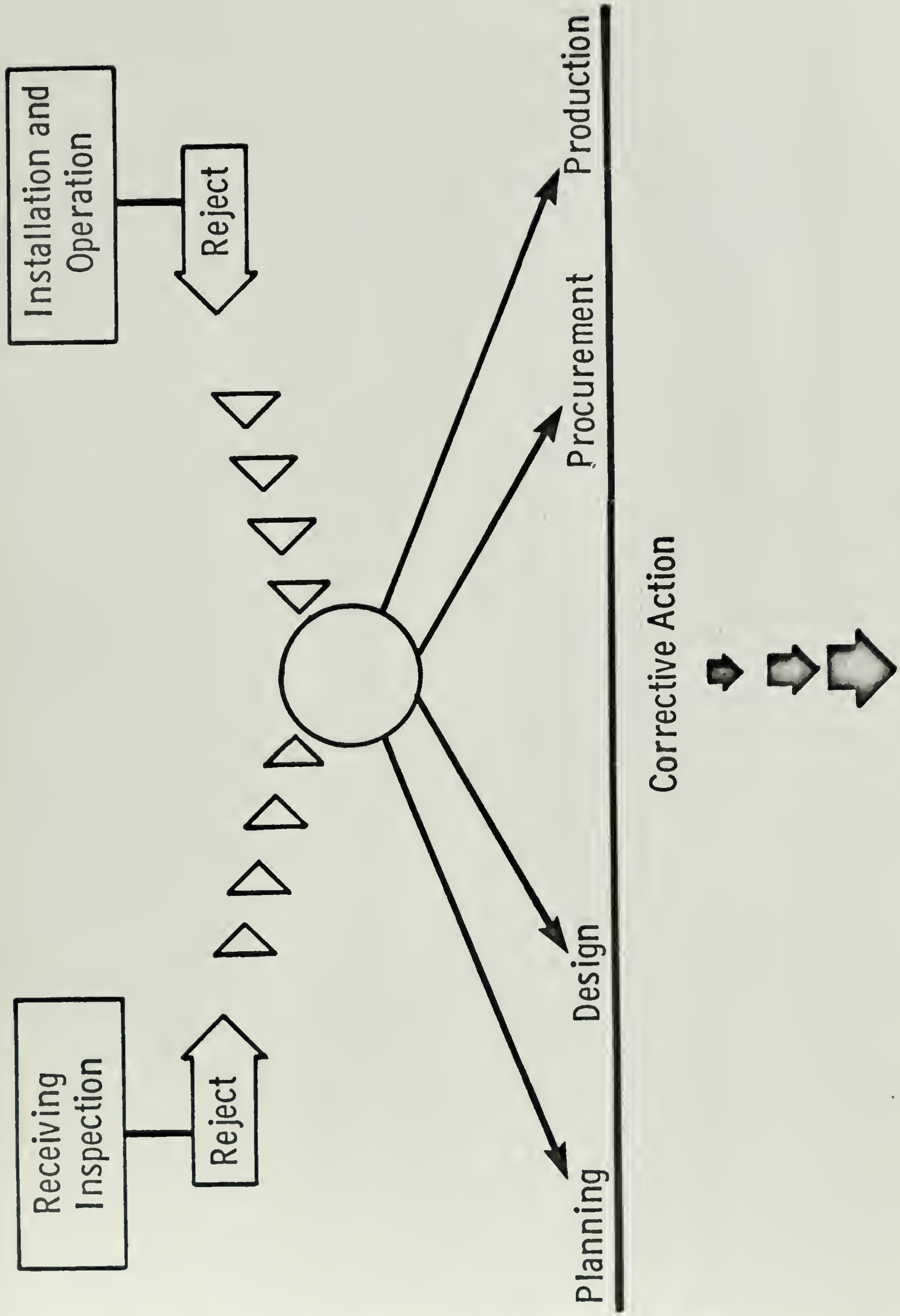

Fig. 2.--Defect Prevention Feedback System

A volume of 1,334 individual defect prevention reports for new ships parts were received. Table 1 on page 58 indicates the different types of defect reports submitted. It also indicates the type of actions initiated for these reports.

A review of Table 1 shows that three of the shipyard and repair activities involved submitted no reports and about 46 percent submitted less than ten. This, however, is an increase in the number of reports received over 1963 when thirteen activities did not submit any reports. It appeared that this increase in reports was primarily a result of a wider compliance with the program in 1964, the first year after the loss of USS THRESHER, rather than an increase in the number of actual defective parts received.

Table 2 on page 59 provides a breakdown, on a percentage basis, of the relation of the defects in each of the sixteen categories involved to the total number of defects reported in calendar year 1964. The sixteen defect categories were reported 1,511 times. 633 defects were associated with GFM and 878 were associated with CFE. The difference between 1,334, the number of DPRs for calendar year 1964, and 1,511, the types of defects, is a result of the DPR recording a defect in more than one category.

A review of Table 2 indicates that the higher percentages for CFE defects are 20.5 and 16.8 and that these are applicable to the material and workmanship categories respectively. Defects attributed to material and workmanship for GFM are also among the higher percentages reported, amounting to 9.6 and 23.4 respectively. As noted in Appendix I, defects categorized as workmanship are a result of items showing evidence of poor or faulty fabrication or assembly including the presence of dirt, burrs, and foreign matter. Those attributed to material are a result of items failing to meet the specifications applicable to such items.

TABLE 1

INFORMATION ON DEFECT PREVENTION REPORTS FOR 1964

Reporting Activity	Defect Prevention Reports Received		INM Complaint Investigation Reports Received		BuShips Prevention Action Initiated	BuShips Review Indicated No BuShips Action Required
	CFE	GFM	CFE	GFM	GFM	GFM
1. NSY, BSN	3	17	-	1	2	-
2. NSY, CHASN	5	19	-	-	4	2
3. NSY, LBEACH	-	9	-	5	6	-
4. NSY, MARE	8	37	3	-	7	-
5. NSY, NY	8	22	-	1	-	-
6. NSY, NORVA	-	6	-	1	1	-
7. NSY, PEARL	-	-	-	-	-	-
8. NSY, PHILA	28	15	-	3	10	1
9. NSY, PTSMH	135	20	65	6	6	-
10. NSY, BREM	-	-	-	-	-	-
11. NSY, SFRAN	1	-	-	-	-	-
12. SOS, BATH	5	1	2	-	-	-
13. SOS, BAY CITY	12	7	3	1	-	-
14. SOS, CAMDEN	62	-	21	-	-	-
15. SOS, GROTON	203	157	107	46	124	9
16. SOS, LBEACH	-	7	-	-	3	-
17. SOS, NPTNWS	197	204	109	16	50	28
18. SOS, NY	-	-	-	-	-	-
19. SOS, PASCAGOULA	58	49	15	10	23	1
21. SOS, SFRAN	2	9	-	-	-	-
22. SOS, SEATTLE	11	14	2	2	4	-
23. SOS, NRLNS	-	1	-	-	-	-
28. INDMAN FIVE	-	1	-	-	-	-
47. NAS SEATTLE	-	1	-	-	-	-
Totals	738	596	327	92	240	41

Notes:

Several INM complaint investigations on the 1964 DPRs are on file in BuShips, but they were received in 1965 after the 31 December 1964 report cut-off date. These have not been included in these totals.

Activity numbers 20 and 24-46 have been reserved for INDMAN and other activities that may be assigned.

TABLE 2

DEFECTS CATEGORIZED BY CHARACTER OF DEFECT FOR 1964

		CFE		GFM	
		Defect	%	Defect	%
1.	Mechanical Test	35	4.0	26	4.1
2.	Non-Destructive Test	22	2.5	1	.1
3.	Pressure Test	40	4.5	5	.8
4.	Electrical/Electronic Test	50	5.6	120	19.0
5.	Workmanship	147	16.8	148	23.4
6.	Identification	119	13.6	65	10.3
7.	Damage	50	5.6	88	14.0
8.	Missing Parts	19	2.1	38	6.0
9.	Dimension Incorrect	112	12.8	34	5.4
10.	Material	179	20.5	61	9.6
11.	Machining	23	2.6	8	1.2
12.	Welding	8	1.1	12	1.9
13.	Soldering	2	.2	4	.6
14.	Preservation/Packaging/Packing	20	2.2	21	3.3
15.	Shelf Life	3	.3	2	.3
16.	No Objective Evidence of Inspection	49	5.6	0	.0
	Totals	878	100.0	633	100.0

The resume presented below is typical of the DPRs forwarded.

Company X transferred to Company Y a main propulsion reduction gear, a hydraulic pump motor, and a clutch control panel. These units listed below were rejected at receiving inspection and were reported on a DPR for the reasons indicated.

Propulsion Reduction Gear

1. Rust had accumulated on the internal gears, inside the hinged inspection plates, and related parts.
2. The chains that fasten the padlocks to the casing were secured in a poor manner. These padlocks could drop into the gear case when the hinged inspection plates were open.
3. Rust was on lower casing and piping.

Hydraulic Pump Motor

1. A direction or rotation arrow was missing.
2. A lead clamp had not been provided.
3. Terminal leads were not properly identified.

Clutch Control Cabinet

1. The wrong type of wire was used.
2. Locking devices were missing in several places throughout the cabinet.
3. The easy code markers did not comply with the requirements of BuShips letter 9620.66, Serial No. 660E-385 of May 8, 1961.
4. The cover was inaccessible.

As a direct result of the Defect Prevention Report received on these units, BuShips requested that INM advise the prime contractor involved of the defects on the reduction gear. BuShips also requested that a

complaint investigation be performed and that a report of the findings and actions taken to prevent recurrence be forwarded to BuShips.

Investigation determined that the rusted condition of the main propulsion reduction gears had been caused by inadequate preservation and improper storage during the interim storage period prior to shipment to Company Y. It was evident that the roof had been leaking over the area where the unit had been stored. As a result, the INM office instituted action to physically evaluate the condition of all reduction gear and turbine units in storage at Company X.

Slides and photographs taken of the rusted conditions were forwarded to Company X and shown to all assembly and test men, shippers, management, and quality control personnel. Many constructive comments were generated among those who received these photos, and a greater appreciation was obtained for adequate preservation and protection during storage periods. The repair and correction of the rust conditions was accomplished to the satisfaction of Company Y and the Navy.

The chains securing the padlocks were improperly selected for this application. A design change was made to properly secure chains to the casing, eliminating the possibility of padlocks dropping into the gear casing.

The defects pertaining to the motor and control cabinet as reported on the DPR involved strengthening of specifications. This resulted in action by BuShips to correct and revise the specifications involved.

The detection and correction of these defects at a point in time prior to installation aboard ship saved many manhours in time and money. If these defects had not been detected and corrected, it was evident that the safety

of operating personnel and equipments would have been placed in jeopardy.

A review of failure report information for calendar year 1965 reveals that twenty-three activities submitted DPRs on new parts for shipbuilding and repair of ships. As a result of the revision to BuShips initial DPR Instruction, as previously mentioned, the information submitted included defects for new ships parts received from ICP's stock. As to the defect terms used, two defect categories, one pertaining to technical data and the other to a design deficiency, were added to the sixteen categories used in 1964. A list of the activities that submitted DPRs along with a definition of two additional defect categories used in 1965 is reflected in Appendix II.

A total of 1,716 individual defect prevention reports were received in 1965. Table 3 on page 63 indicates the number of the different types of defects submitted. This table also reflects the corrective actions initiated and completed for these reports.

A review of Table 3 reveals that three of the shipyard and repair activities involved submitted no reports and about 29 percent submitted less than ten. Even with one less activity reporting, 1,501 valid DPRs were received in 1965 as compared to 1,334 DPRs received in 1964. The 215 DPRs in the column designated "OTHERS" are considered invalid in that they were erroneously issued against stock items for obvious reasons such as wrong shelf issue, mixed stock, and wrong stock numbers. Despite the continual increase in the number of DPRs received, discussions with various NAVSHIP, NAVSUP, and SPCC officials indicate that additional emphasis on this program is still required for maximum benefit.

Table 4 on page 64 provides a breakdown, on a percentage basis, of the relation of defects in each category to the total number of defects reported

TABLE 3

INFORMATION ON DEFECT PREVENTION REPORTS FOR 1965

Reporting Activity	Defect Prevention Reports Received				Corrective Actions Initiated			Corrective Actions Completed		
	CFE	GFM	ICP	OTHERS	CFE (CAS)	GFM (BU)	Stock (ICP)	CFE (CAS)	GFM (BU)	Stock (ICP)
1. NSY, BSN	-	60	82	6	-	20	19	-	1	1
2. NSY, CHASN	18	21	101	51	7	10	55	6	6	31
3. NSY, LBEACH	2	9	9	2	-	4	2	-	-	1
4. NSY MARE, SF BAY	76	6	4	5	38	4	1	19	1	-
5. NSY, NY	4	-	-	-	1	-	-	-	-	-
6. NSY, NORVA	5	-	68	25	1	-	39	1	-	18
7. NSY, PEARL	-	-	5	-	-	-	5	-	-	4
8. NSY, PHILA	14	10	6	2	12	6	2	11	3	-
9. NSY, PTSMH	414	16	55	22	205	11	35	155	6	18
10. NSY, BREM	3	29	5	1	3	20	2	1	1	-
11. NSY HUNPT, SF BAY	-	2	10	-	-	-	6	-	-	-
12. SOS, BATH	3	8	2	-	-	3	2	-	-	-
13. SOS, BAY CITY	2	8	3	1	2	4	2	2	2	2
14. SOS, CAMDEN	42	13	-	4	18	11	-	9	7	-
15. SOS, GROTON	82	51	5	11	29	38	3	27	17	2
16. SOS, LBEACH	-	2	-	-	2	-	-	-	-	-
17. SOS, NPTNWS	39	82	3	7	28	51	-	26	29	-
18. SOS, NY	-	-	-	-	-	-	-	-	-	-
19. SOS, PASCAGOULA	28	22	15	69	15	12	10	14	10	6
21. SOS, SFRAN	-	-	-	-	-	-	-	-	-	-
22. SOS, SEATTLE	-	15	2	7	-	6	2	-	5	-
23. SOS, NRLNS	20	10	-	2	5	10	-	3	10	-
25. SOS, JAX	-	-	-	-	-	-	-	-	-	-
Other Activities	-	10	-	-	-	5	-	-	2	-
Totals	752	374	375	215	364	217	185	274	100	83

TABLE 4

DEFECTS CATEGORIZED BY CHARACTER OF DEFECT FOR 1965

Defect	CFE		GFM		ICP	
	Amt	%	Amt	%	Amt	%
1. Mechanical Test	24	2.4	9	1.7	10	2.3
2. Non-Destructive Test	98	10.0	-	-	15	3.4
3. Pressure Test	14	1.4	5	.9	12	2.7
4. Electrical/Electronic Test	23	2.3	98	18.3	31	7.0
5. Workmanship	136	13.7	131	24.4	48	10.9
6. Identification	81	8.1	16	3.0	13	2.9
7. Damage	48	4.8	71	13.2	60	13.6
8. Missing Parts	11	1.1	20	3.8	5	1.1
9. Dimension Incorrect	77	7.8	22	4.1	33	7.5
10. Material	206	20.7	96	17.9	128	29.0
11. Machining	11	1.1	4	.7	3	.7
12. Welding	9	.9	4	.7	-	-
13. Soldering	3	.3	-	-	-	-
14. Preservation/Packaging/Packing	12	1.2	43	8.0	40	9.0
15. Shelf Life	-	-	2	.4	21	4.7
16. No Objective Evidence of Inspection	227	22.9	3	.5	15	3.4
17. Technical Data	9	.9	5	.9	4	.9
18. Design Deficiency	4	.4	8	1.5	4	.9
Totals	993	100.0	537	100.0	442	100.0

for the three groups of material involved. The 1,501 valid DPRs are categorized by the nature of the deficiency and classified into eighteen defect categories. The eighteen defect categories were reported for a total of 1,972 times; 537 were associated with GFM, 993 were associated with CFE, and 442 were associated with stock items from ICPs. The difference between 1,501, the number of valid DPRs reported, and 1972, the number of defect categories reported, is a result of many DPRs containing defects in more than one category.

A review of Table 4 indicates that DPRs due to workmanship and material represent the higher of the percentages reported for the eighteen defect categories. DPRs with defects recorded in the material category represent 20.7, 17.9, and 29.0 percent of the CFE, GFM, and ICP items respectively. DPRs with defects recorded in the workmanship category represent 13.7, 24.4, and 10.9 percent of the CFE, GFM, and ICP items respectively. Of the remaining sixteen defect categories, twelve, thirteen, and twelve for the CFE, GFM, and ICP items, respectively, show less than five percent for each category.

In processing corrective actions on DPRs by cognizant activities such as DCASR, NAVSHIP, or the ICPs, delay is encountered. This is due to time required to receive the DPR, physically perform the investigation, and submit the formal reply.

The case report described below is typical of defective material received from the Naval Supply System.

> The Supervisor of Shipbuilding, Bay City, Michigan, submitted a DPR to the Ships Parts Control Center, Mechanicsburg, Pennsylvania, on two magnetic compasses manufactured by Company Z. These compasses were originally received and stored at NSC, Norfolk, prior to transhipment

to Bay City. Receiving inspection at Bay City rejected the compasses because of the following defects:

1. Compass liquid was dirty.
2. Compass card was discolored.
3. Immediate area around screw head was deteriorated.

The compasses were returned to the manufacturer for investigation, analysis, and corrective action. The findings were:

1. Insufficient compass cleaning at final assembly caused compass liquid contamination which in turn was responsible for compass card discoloration, and
2. Improper handling and storage at the Naval Supply Center, Norfolk, resulting in a bent card support which was responsible for compass card sticking.

Both compasses were repaired by the manufacturer and returned to the Naval Supply Center.

Company Z has promised to exercise greater care in future production in an effort to avoid recurrence of this problem. The cognizant government quality assurance representative advised that he would exercise additional surveillance of the company's cleaning procedure.

As a result of this DPR, SPCC's stock purge resulted in the discovery of two additional compasses in stock with the same defects. These were also returned and repaired by the manufacturer. Action by SPCC in effecting repair of the two other compasses in the stock system was accomplished at no cost to the government.

Observations

In shipbuilding and ship repair, the assurance of quality in design, procurement and production traditionally has been largely informal, unrecorded, and unsystematic.[8] As the implications of a mistake become more and more expensive, there is a greater need for predetermined and systematic definition of what will be checked, what records will be kept, and what the results of analyzing the records mean in terms of corrective action.

Even though the DPR Program is costly, it is most desirable. Although no precise figure can be placed on the total cost of such a program as the DPR for assuring quality as an average for all industry or government, it has been recognized by professional societies and major industries of the United States that 8 to 15 percent of the total cost of an operation may be involved in securing adequate quality in the final product. In the aerospace industries, this cost has occasionally risen to 300 percent of the total cost of an individual product and to 75 percent of the total contract cost to secure adequate assurance of reliability. For the shipbuilding and ship repair industry this would appear to be unreasonable. A brief review of current new ship construction and repair practices indicates that such costs are now approaching and exceeding 15 percent and are expected to increase in the next few years.[9]

The DPR program, while it obviously costs money, can ultimately save even more than it costs. By locating faulty material before installation,

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[8]U.S., Department of the Navy, Naval Ship Systems Command, Quality Assurance Orientation, October 20, 1966, p. 4.

[9]U.S., Department of the Navy, Naval Ship Systems Command, Quality Reliability Assurance for Shipyard Application; NAVSHIP 250-706-35, May, 1964, section 4.3.3.

[illegible]

In shipbuilding and ship repair, the assurance of quality in design, procurement and production traditionally has been largely informal, non-uniform, and unsystematic.[6] As the sophistication of a military [illegible] becomes more and more expensive, there is a [illegible]

Even though the [illegible] program is costly, it is most beneficial. Although no precise figure can be placed on the total cost of [illegible]

[illegible]

The [illegible] program, which is relatively new, [illegible]

[6]U.S., Department of the Navy, Naval Ship Systems Command, [illegible]

[7]U.S., Department of the Navy, Naval Ship Systems Command, Quality [illegible]

extensive disassembly of equipment can be averted. Past experience has shown that sea trials are an expensive way to locate faulty material. Frequently, faulty material is so located that good ship piping and other equipment must be removed to get to a faulty component or part. While the DPR program administrative costs may be high, they usually are cheap when compared to the tangible and intangible costs associated with this type of operation.[10]

It is an objective of shipbuilders and ship operators to use ships parts of a quality that will perform adequately and have such items as may be required in ready-for-use condition to meet building and operational commitments. Since it is difficult to establish an inflexible standard as to what constitutes a quality part, it is generalized or assumed that an item is a quality part if it will perform adequately to its design requirements. Any defect that would prevent this constitutes substandard material. Therefore, an increase in the volume of reports on defective ships parts, while frequently resulting in building schedule setbacks, must be properly dealt with if the objective desired is to be obtained.

It is evident that the number of defects submitted in connection with the DPR program is on the increase. A review of prior performance revealed that DPRs submitted increased from a total of 279 in 1963 to 1,334 in 1964 to 1,501 in 1965. While these reports are increasing, it is apparent that some reporting activities are not actively participating in the DPR program. Five activities have submitted five or less DPRs. Of the twenty-three shipyard, repair facility, and supervisor of shipbuilding offices currently

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[10]Letter by R. K. James, Chief, Bureau of Ships, Washington, D. C., March 8, 1961.

required to report, two have not as yet submitted any DPRs. The reporting activities involved have a shipbuilding and ship repair production volume sufficient to indicate that all significant costly and recurring defects are not being reported.[11]

In discussions with NAVSHIP, NAVSUP, and SPCC officials, it was revealed that deficiencies in ships parts are not always reported back through the complete chain for the information and corrective action of designers, specification writers, and others who need to know. In fact, it was noted that INDMANs involved in ship construction and repair at private contractor sites are currently excluded from the DPR program.[12] It was also noted that private shipbuilders do not perform test inspections for GFM.[13] While it appeared that action is to be taken to correct this and that action is initiated to correct defects detected for the ships parts involved, it is evident that the information generated thereby is not, in the interim, being fed back to all parties concerned to minimize the recurrence of such defects.

While the above highlights certain problem areas and weaknesses of the DPR program, it was noted that the DPRs themselves do not, in many cases, convey all the important parameters connected with the defects being reported. Defect identification information, such as a specification paragraph, drawing, and description of the part or section thereof that is defective, and recommended corrective action to be taken to preclude recurrence are frequently not included in the report.

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[11]U.S., Department of the Navy, Naval Ship Systems Command, Naval Ship Engineering Center Notice 4355; Serial 6609.1-261, July 8, 1966, p. 17.

[12]Ibid., p.5.

[13]U.S., Department of the Navy, Naval Ship Systems Command, Quality/ Reliability Assurance Program, August, 1964, pp. 4-16.

It was observed that DPR replies, or reports of DPR investigations and corrective actions, do not always provide evidence of adequate investigation and/or corrective action. In fact, a notice issued by the Naval Ship Engineering Center indicates that DPR replies frequently fail to indicate that an investigation, a corrective action, and a report is required by each of the responsible activities involved. In this regard, it was also evident that the most common faults with DPR replies are that:

1. Copies are not being furnished to appropriate offices, and

2. Responsible offices are failing to indicate the action that they are taking or will take to prevent a recurrence of the defect involved.[14]

From the information reviewed, it was observed that the data obtained on ships parts from the collection of the three different types of failure reports was to be used to:

1. Prevent the supply of questionable or unsatisfactory parts to ships,

2. Correct production errors and processes,

3. Correct design errors or inadequacies,

4. Assist in maintenance management,

5. Determine replacement requirements, and

6. Establish the extent of supplier and government responsibility.

While several NAVSHIP, NAVSUP, and SPCC officials attested to the feasibility and desirability of reducing the three forms to one, no action was in process to formulate one uniform report for accomplishing the purposes involved.

It was noted that administrative actions designed to accomplish the purposes listed above were being initiated on a defective report or item by

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[14]Naval Ship Engineering Notice 4355, loc. cit., p. 18.

a defective report or item basis. The percent of failure of the items reflected in these reports in respect to the total population of such items was not being considered. Trend information in respect to the number of defects for a particular equipment or system, such as SINS or SubSafe equipments, was not determined or evaluated. The information accumulated was neither related to a mission nor compared to a standard of performance expected for the areas involved. Notably missing from the information received was the cost of the various items for which defect information was being received and processed. In addition to follow-ups frequently being too slow to expedite the processing of such information, no time limit was imposed as to when the reports were to be submitted for the defects detected and when administrative actions were to be completed on such reports by the parties involved.

CHAPTER V

OBSERVATIONS AND RECOMMENDATIONS

The author's observations and recommendations are based on a limited review of the broad and complex organizations and administrative controls applicable to the quality of parts for naval vessels. Recognizing the limitations of such a review, this chapter will include a summary of significant observations and will provide recommendations considered worthy of study and/or initiation to correct the administrative weaknesses detected. The opinions expressed herein are strictly those of the author and have no official sanction.

Summary of Recommendations

From the information reviewed, it was evident that the organizational relationships of NAVSHIP and NAVSUP in respect to their responsibilities for the acquisition of ships parts are clearly defined. Shortcomings in the relationships appear to stem primarily from procedural faults rather than any major organizational defects. Certain procedures were noted to be outdated and in some cases inadequate. While the ships parts support functions of CNM are clearly divided between NAVSHIP and NAVSUP, CNM has neither policed the relationships that have developed between these commands nor conducted any reviews to insure that appropriate quality control procedures for the acquisition of ships parts are in effect within NAVSHIP and NAVSUP and that these procedures are being followed.

It was observed that the supply support quality control procedures applicable to the acquisition of ships parts were different for different parts. With the exception of nuclear parts, the technical and procurement related data received by SPCC was observed to be somewhat incomplete in that the exact requirements as to the quality required was often subject to the interpretation and judgment of the SPCC technician involved. It appeared evident that the quality processes required for some parts were known only by certain manufacturers. While the procedures followed appeared adequate for standard stock items, it was apparent that improvement in the technical data provided SPCC in terms of the quality required for specialized parts that are essential to a ship's mission was needed.

A review of the results of these procedures in terms of the NAVSHIP and NAVSUP defective prevention reports revealed that all information on ships parts defects are not being submitted to NAVSHIP, NAVSUP, and SPCC. As to those being reported, it was evident that present procedures do not require that defects detected in ships parts be submitted and corrective action thereon be completed within a prescribed time period. As to the reports received, it was observed that the items with defects are not being evaluated in respect to either the percentage they represent of the total population in use or their effect on the mission, program, or system and equipment assembly or system involved. While actions taken on the reports reviewed appeared to be improving the quality of ships parts, additional emphasis was obviously needed to expedite present processing, expand information being reported, and generate the development of a uniform system of reporting defective ships parts.

Recommendations

The following recommendations are based upon research conducted within the limitation imposed in the Introduction of this paper and as such are not deemed to be all inclusive or infallible. It is recognized that work may be proceeding on some of these recommendations. For others, the difficulties are great and implementation may prove to be unfeasible from a practical viewpoint. However, they are in every case deserving of consideration. Adoption of any or all will aid in the achievement of greater reliability in ships parts.

Centralized direction in the administrative control of quality of ships parts is vested in the CNM. CNM should periodically review the quality control procedures of NAVSHIP and NAVSUP to insure that they are current and that they are accomplishing the objectives that CNM has assigned to these two commands.

NAVSHIP and NAVSUP should periodically review their internal quality control procedures and those of their field activities to insure that they are updated to conform with current requirements. To insure that NAVSHIP's technical and NAVSUP's management responsibilities in respect to the quality control of ships parts are properly fulfilled, it is recommended that all changes to present quality control procedures be concurred in by both parties. Areas of dissension should be resolved by CNM.

Since the furnishing of quality requirements for the procurement of ships parts is a responsibility of NAVSHIP, action should be taken by this command to insure that such requirements are provided appropriate procurement activities and changes or waivers thereto are approved by it for each part that is considered essential to the missions of ships. This will require a

determination by NAVSHIP as to the parts involved and a development of a format for furnishing such information to the naval procuring activities affected. The procedure currently followed for identifying quality requirements for nuclear parts appears sound and should be considered for application in non-nuclear areas. In any event, one uniform system for providing quality requirements for ships parts to procurement activities should be developed and followed.

As to the reports on defective parts, it is recommended that one form be developed and used. In this respect, present defective report procedures should be modified to require that defects detected be reported and corrective action thereon be completed within a specified time period. As to the defective prevention report system, it should be enlarged to include all activities involved with shipbuilding and ship repair and should require the submission of such additional information that is needed not only to evaluate trends in respect to ships systems or programs and equipment but also to aid in the measurement and improvement of mission effectiveness and performance of vendors and others involved in providing quality parts for naval vessels.

APPENDIX I

LIST OF DEFECT REPORTING ACTIVITIES AND DEFINITIONS OF DEFECT CATEGORIES 1964

Reporting Activity Key Number	Reporting Activity
1	U.S. Naval Shipyard, Boston, Massachusetts
2	U.S. Naval Shipyard, Charleston, South Carolina
3	U.S. Naval Shipyard, Long Beach, California
4	U.S. Naval Shipyard, Mare Island, California
5	U.S. Naval Shipyard, New York, New York
6	U.S. Naval Shipyard, Norfolk, Virginia
7	U.S. Naval Shipyard, Pearl Harbor, Hawaii
8	U.S. Naval Shipyard, Philadelphia, Pennsylvania
9	U.S. Naval Shipyard, Portsmouth, New Hampshire
10	U.S. Naval Shipyard, Puget Sound, Washington
11	U.S. Naval Shipyard, San Francisco, California
12	Supervisor of Shipbuilding, Bath, Maine
13	Supervisor of Shipbuilding, Bay City, Michigan
14	Supervisor of Shipbuilding, Camden, New Jersey
15	Supervisor of Shipbuilding, Groton, Connecticut
16	Supervisor of Shipbuilding, Long Beach, California
17	Supervisor of Shipbuilding, Newport News, Virginia
18	Supervisor of Shipbuilding, New York, New York
19	Supervisor of Shipbuilding, Pascagoula, Mississippi

21	Supervisor of Shipbuilding, San Francisco, California
22	Supervisor of Shipbuilding, Seattle, Washington
23	Supervisor of Shipbuilding, New Orleans, Louisiana
28	Indman, 5th Naval District, Norfolk, Virginia
47	Naval Air Station, Seattle, Washington

Definitions of Defect Categories:

1. Mechanical Test - Item fails to meet Functional or Operational Test Requirements.
2. Non-Destructive Test - Item fails to meet Non-Destructive Test Requirements, i.e., Radiographic, Ultrasonic, Magnetic Particle, Fluorescent Penetrant, Dye Penetrant, or other types of Non-Destructive Tests.
3. Pressure Test - Item fails to meet Pressure Requirements (gas, liquid, etc.), i.e., Pre-installation, Installation, or Operational.
4. Electrical/Electronic Test - Item fails to meet Electrical/Electronic Operational or Functional Requirements.
5. Workmanship - Item shows evidence of poor or faulty fabrication or assembly including dirt, burrs, foreign matter.
6. Identification - Not identified as ordered (improper marking, lack of marking, insufficient marking).
7. Damage - Damage that impairs the usefulness or value of an item.
8. Missing Parts - Part or parts missing from assembly or set.
9. Dimensions Incorrect - Item fails to meet Requirements of Plan (DWG) and/or Procurement Document.
10. Material - Item fails to meet material specifications.

11. Machining - Item shows evidence of poor machining practice (surface finish, etc.).

12. Welding - Item shows visual evidence of poor welding (spatter, etc.).

13. Soldering - Item shows visual evidence of poor soldering (excessive solder, etc.).

14. Preservation/Packaging/Packing - Item improperly preserved, packaged, or packed, or inadequate preservation, packaging, or packing requirements.

15. Shelf Life - Item stored for periods that reduced or exceeded maximum item life.

16. No objective evidence of Inspection - Item not subjected to government source inspection; lack of test or physical composition data (certification).

APPENDIX II

LIST OF REVISED DEFECT REPORTING ACTIVITIES AND DEFINITIONS OF DEFECT CATEGORIES 1965

Reporting Activity Key Number	Reporting Activity
1	U.S. Naval Shipyard, Boston, Massachusetts
2	U.S. Naval Shipyard, Charleston, South Carolina
3	U.S. Naval Shipyard, Long Beach, California
4	U.S. Naval Shipyard, Mare Island Division, San Francisco, California
5	U.S. Naval Shipyard, New York, New York
6	U.S. Naval Shipyard, Norfolk, Virginia
7	U.S. Naval Shipyard, Pearl Harbor, Hawaii
8	U.S. Naval Shipyard, Philadelphia, Pennsylvania
9	U.S. Naval Shipyard, Portsmouth, New Hampshire
10	U.S. Naval Shipyard, Puget Sound, Washington
11	U.S. Naval Shipyard, Hunters Point Division, San Francisco, California
12	Supervisor of Shipbuilding, Bath, Maine
13	Supervisor of Shipbuilding, Bay City, Michigan
14	Supervisor of Shipbuilding, Camden, New Jersey
15	Supervisor of Shipbuilding, Groton, Connecticut
16	Supervisor of Shipbuilding, Long Beach, California
17	Supervisor of Shipbuilding, Newport News, Virginia
18	Supervisor of Shipbuilding, New York, New York

19	Supervisor of Shipbuilding, Pascagoula, Mississippi
21	Supervisor of Shipbuilding, Hunters Point Division, San Francisco, California
22	Supervisor of Shipbuilding, Seattle, Washington
23	Supervisor of Shipbuilding, New Orleans, Louisiana
24	Supervisor of Shipbuilding, Jacksonville, Florida

The same defect category terms as used in Appendix I for the 1964 calendar year apply with the addition of the following two categories:

17. Technical Data - Engineering drawings and other technical documents did not contain adequate and accurate data and/or procedures, i.e., operation, maintenance, repair, manufacturing, or installation data.
18. Design Deficiency - Item not suitable due to inadequate design.

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